

Implementing Hospital Autonomy in Jordan: An Economic Cost Analysis of Princess Raya Hospital

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- ▲ *Delivery of quality services by health workers.*
- ▲ *Availability and appropriate use of health commodities.*

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Abstract

Faced with limited resources and increased demands being placed upon its health care sector due to changing pattern of diseases and rising consumer expectations, the Ministry of Health (MOH), of the Hashemite Kingdom of Jordan is seeking ways to improve the operating efficiency of its 23 public hospitals. One way to achieve the objective is to provide hospital directors with greater managerial control over their daily decision-making. As such, the government of Jordan has been engaged during the past three years in a hospital autonomy (hospital decentralization) pilot project with Princess Raya and Al Karak hospitals. To date the MOH has completed the first three phases of that project: Phase 1 (the pilot site selection process), Phase 2 (the implementation of short-run changes in operating procedures), and Phase 3 (estimating the costs of services at the hospitals). This document details Phase 3 activities, presenting the first-ever detailed cost analysis of Princess Raya hospital. This analysis is of import, given that the MOH is considering the allocation of a partial or complete operating budget to the hospital director, at a later date.

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Acronyms

AFC	Average Fixed Costs
ALOS	Average Length of Stay
ATC	Average Total Cost
AVC	Average Variable Cost
DGFA	Director General of Finance and Administration
ER	Emergency Room
FC	Fixed Costs
FTE	Full-time Equivalent
ICU/CCU	Intensive Care/Critical Care Unit
JD	Jordanian Dinar
L_c	Labor Costs
L_n	Labor [Cost of] Nurses
L_p	Labor [Cost of] Physicians
L_{pn}	Labor [Cost of] Physicians and Nurses
MOF	Ministry of Finance
MOH	Ministry of Health
N_c	Nonutility Cost
OB/GYN	Obstetrics and Gynecology
OR	Operating Room
PHR	Partnerships for Health Reform
PHR_{plus}	Partners for Health Reform _{plus} Project (USAID)
RMS	Royal Medical Service
TC	Total Costs
U_c	Utility Costs
USAID	United States Agency for International Development
V_c	Variable Costs

Currency Conversion

JD 1 = US\$ 1.41

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Finally, we would like to acknowledge the participation and support of our Ministry of Health and *PHRplus* colleagues in Jordan and the United States.

Executive Summary

The Ministry of Health (MOH) of the Hashemite Kingdom of Jordan has expressed keen interest in granting at least partial autonomy to its MOH owned and operated hospitals. The Partnerships for Health Reform (PHR), a United States Agency for International Development (USAID)-sponsored project and predecessor to Partners for Health Reform *plus*, began providing ongoing technical assistance during *Phase 1* of the Ministry's short-run hospital decentralization effort. Initial assistance was the sponsorship of a national workshop entitled "Hospital Autonomy in Jordan," held in Amman on 4 October 1998, at the behest of then-Minister of Health, His Excellency Dr. Na'el Al-Ajlouni. The directors general of the 12 health governorates, as well as the directors of all MOH hospitals attended the workshop (Sindaha-Muna, 1998). During subsequent meetings between PHR and the Minister of Health, it was decided that the MOH would proceed with *Phase 1* of its decentralization efforts. This entailed the selection of two MOH facilities for piloting hospital autonomy in Jordan. The hospitals selected were Princess Raya, in the Irbid governorate, and Al Karak, in the Karak governorate. Their selection in April 1999 concluded *Phase 1* (Banks, 1999).

During *Phase 2*, PHR engaged in several activities to achieve the following set of objectives: (1) to establish "Reference Committees" and "Workgroups" within each pilot hospital; (2) to guide each pilot hospital toward achieving its targeted short-run decentralization objectives; (3) to facilitate the implementation of a detailed training plan, consistent with the expected needs of each pilot hospital; and (4) to facilitate the overall implementation of the short-run recommendations, as explicated by the hospital-based workgroups. This information, as well as the short-run procedural changes that were approved and implemented by the MOH were detailed in a document entitled *Implementing Hospital Autonomy in Jordan: Changing MOH Operating Procedures* (Banks, As-Sayaideh, Shafei, and Ghanoum, 2000).

Finally, *Phase 3* of the Ministry of Health's short-run decentralization activities entailed working closely with PHR *plus* to conduct a detailed cost analysis of hospital services at both Princess Raya and Al Karak hospitals. This document details the results of the study that was conducted at Princess Raya hospital during the period 2000-2001. All data reported in this study is for the year 1 January 1999 to 31 January 1999. A similar study was conducted at Al Karak hospital and is presented in a separate document (Banks, As-Sayaideh, Shafei, and Muhtash, forthcoming).

Background

In Jordan the governance of MOH hospitals is highly centralized. All significant managerial, budgetary, and procurement matters are ultimately decided by senior-level executives, at the MOH headquarters in Amman. This has created a system in which the needs of hospitals and their patients frequently conflict with the policies of the central ministry. This has led many to speculate that MOH hospitals could be more efficiently operated, and the level of quality enhanced, if greater independence were granted to these institutions. In fact, hospital directors have overwhelmingly stated that greater independence over personnel, financial, and procurement matters is necessary for achieving MOH cost containment objectives. A well-planned, carefully designed policy can take as long as 10 years to fully implement. Hence, the government of Jordan has divided its implementation

plan into short-run and long-run objectives. The country is now completing *Phase 3* of its short-run decentralization objectives: that is, identifying the existing cost structure at MOH hospitals, and the establishment of a *Hospital Policy Forum* to coordinate and disseminate information among various MOH hospital directors.

Phase 3 Activities

The Hospital Decentralization Implementation Team worked closely with the staff at Princess Raya hospital, visiting the site weekly throughout the period of this study. In addition to educating hospital staff on the theory and applications of hospital costing, the team guided hospital personnel through the following activities:

- ▲ Establishing workgroups with specific assignments for compiling and analyzing hospital-based data, to include comparisons of hospital-based statistics with those being compiled at the central ministry. This included the development and validation of equipment and drug inventory lists.
- ▲ Building capacity to understand the theoretical aspects of hospital costing. Personnel were provided information on the differences between accounting principles and economic principles in estimating the total economic costs of operating Princess Raya hospital.
- ▲ Guiding workgroups on the principles of data validation, and various allocation rules for distributing costs among various hospital cost centers. Working with the Implementation Team members, hospital personnel devised allocation rules to distribute various input costs among cost centers.

Once these steps had taken place, the Implementation Team cooperated with the workgroups to develop a strategy for compiling ongoing hospital economic data. For example, a strategy was developed such that the staff at Princess Raya hospital is better able to track the flow of drugs consumption throughout the hospital, by cost centers.

Hospital Cost Study Major Findings

Among the most important accomplishments of *Phase 3* were the findings of this first-ever detailed cost analysis of Princess Raya hospital, as well as the policy implications of such findings. Below are highlights of the findings:

- ▲ The total 1999 operating costs for Princess Raya hospital amounted to JD 1,892,239 (\$2,649,135).
- ▲ Total variable costs including labor amounted to JD 1,519,683 (\$2,127,556) and total fixed costs were JD 372,556 (\$521,578).
- ▲ Administrative costs within the hospital are JD 253,733 (\$355,226). This amounts to more than 13 percent of the hospital's total operating costs.
- ▲ The major proportion of total hospital costs, 80.3 percent, are consumed by variable input factors, the largest of which are the labor costs that are associated with the distribution of administrative/financial services, JD 141,495 (\$198,093), roughly 66 percent of total variable administrative/financial costs.

- ▲ In terms of total costs per patient day, which is a proxy for average total costs, the Intensive Care/Critical Care Unit (ICU/CCU) department exhibited the highest, JD 116 (\$162). This is in contrast to the amounts estimated for Surgery, JD 39, Obstetrics and Gynecology (OB/GYN), JD 23, Internal Medicine, JD 71, and Pediatrics, JD 54.
- ▲ The ICU/CCU also exhibited the highest total costs per admission, JD 342 (\$479). This is in contrast to surgery, JD 115, OB/GYN, JD 52, Internal Medicine, JD 289, and Pediatrics, JD 216.
- ▲ When considering outpatient expenditures, the total costs per Emergency Room (ER) and Outpatient Clinic visit are JD 2.92 (\$4.09) and JD 3.25 (\$4.55), respectively. The vast majority of these costs is attributable to variable factors of production.
- ▲ Total labor costs were JD 764,616 (\$1,070,462). Of this amount, JD 730,186 (\$1,022,260) was for salaries, JD 29,172 (\$40,841) for incentives (bonuses), and JD 5,258 (\$7,361) for transportation allowances, the three largest components of employee compensation within the hospital.
- ▲ The highest labor costs are found within the Internal Medicine department, as well as the lowest estimated average product of labor, as illustrated by Table ES-1.

Table ES-1: Total Labor Costs per Patient Day and Adjusted Patient Day

Unit	Total labor costs per patient day	Total days per unit of labor	Total costs per adjusted patient day
Internal Medicine	JD 44	63	JD 85
Surgery	18	209	54
OB/GYN	9	330	38
ICU/CCU	25	103	131
Pediatrics	26	154	65

- ▲ There is need for greater communication between the MOH Accounting Department and Princess Raya on the issue of payroll-related expenses. Oftentimes, the personnel files at the hospital do not match the personnel payment records of the Accounting Department. A management information system that provides systematic updates concerning the placement of personnel throughout the MOH is warranted.
- ▲ The average variable cost of an ER and clinic visit is JD 2.17 and JD 2.85, respectively. The implications are that under existing cost-sharing rules the MOH is not recovering its average variable cost for each ER and clinic encounter. In fact, for certain category of patients, the MOH can recover its average variable costs by increasing its ER co-payment by 520 fils, and its clinic co-payment for clinic visits by JD 1.20. However, without a more detailed study of the relative productivity of Princess Raya hospital, one cannot rule out that the higher average variable costs estimates are the result of production inefficiencies. Hence, any attempt to recover average variable costs based upon the findings in this study would be premature.

- ▲ Total drug costs for Princess Raya inpatient services were JD 99,296 (\$139,014). This amounted to roughly JD 6 per inpatient day, and more than JD 18 per patient.
- ▲ Once daily hospital services, such as Surgery, OB/GYN, Internal Medicine, ICU/CCU and Pediatrics are loaded with their administrative overhead, the total costs per adjusted patient day is JD 54, JD 38, JD 85, JD 131, and JD 65, respectively.

Conclusions

With the completion of *Phase 3*, the Ministry of Health has taken another step forward in its efforts to decentralize its network of publicly owned and operated hospitals. Hospital workgroups, in collaboration with the Hospital Decentralization Implementation Team, have provided the MOH with detailed information on the costs of operating each pilot hospital. This information will provide the MOH with its first information on the cost structure of each hospital and the distribution of such costs across hospital costs centers. Moreover, this study highlights various areas for policy intervention, such as the establishment of a cost reporting system that tracks and coordinates hospital expenditures throughout the MOH.

1. Background

The Hashemite Kingdom of Jordan is experiencing discouraging economic conditions that include recessionary growth rates, high unemployment, and declining real wages. Such factors place enormous strain on the provision of public services, particularly health care services. As a result, policymakers within the Ministry of Health (MOH) are seeking ways to contain health care costs, while maintaining access to and sustained quality of care, at the country's 23 public hospitals.

1.1 Decentralization of Jordan's Public Hospitals

In Jordan the governance of MOH hospitals is highly centralized. All significant managerial, budgetary, and procurement matters are ultimately determined by senior-level executives, located at the MOH headquarters in Amman. This has created a system in which the needs of individual hospitals and their patients frequently conflict with the policies of the central ministry. This has led many to speculate that MOH hospitals could be more efficiently operated, and the level of quality enhanced, if greater independence were granted to these institutions. In fact, hospital directors have overwhelmingly stated that greater independence in personnel, financial, and procurement matters is a necessary condition for achieving targeted MOH cost containment objectives. However, they also stress that the poor must be protected from any adverse effects in the drive towards improved efficiency. One method by which the government may reconcile these ends is to grant to hospital directors limited autonomy over managerial, budgetary, and procurement matters. As a result, the MOH through its Hospital Decentralization Implementation Team has engaged in a systematic move towards hospital decentralization over the past three and one-half years. *Phase 1* of that policy was completed in April 1999, with the selection of Princess Raya and Al Karak hospitals as pilot institutions for the hospital decentralization effort (Banks, 1999).

During *Phase 2*, the directors of Princess Raya and Al Karak hospitals were provided limited authority over certain aspects of their daily decision making through changes in MOH operating procedures (Banks, As-Sayaideh, Shafei, and Ghanoum, 2000); this included the establishment of workgroups and committees at each hospital, as well as the training of administrative and technical personnel in various aspects of hospital management and finance.

Over the long run the MOH seeks to provide Princess Raya and Al Karak hospitals with additional limited authority, over aspects of their budgetary, planning, and procurement matters. To achieve this, however, the MOH, as well as the hospital directors, need to understand in detail the cost structures at the two hospitals.

During autumn 2000, the Implementation Team initiated *Phase 3* of the decentralization effort. *Phase 3* had two primary components. The first was the development of an organizational development plan for each hospital. The plan provided the MOH with a detailed understanding of the governance structure of each hospital, based upon their short-run decentralization objectives. The second was the aforementioned look at the cost structures at each hospital. Hence, an essential activity of *Phase 3* was a detailed cost analysis at each hospital. This document details the results of that analysis for Princess Raya hospital.

1.2 Princess Raya Hospital

Princess Raya hospital, established in 1995, is located approximately 120 kilometers north of Amman in a hilly, rural region of the Irbid governorate. Its patient population comes from the many nearby villages and towns. Approximately 61 percent of the patient population, for both inpatient and outpatient services, is covered by the Royal Medical Services (RMS). The hospital has recently been selected as a United States Agency for International Development Comprehensive Post Partum facility, and it has an active nurses training facility that is sponsored by the Italian government. Table 1 provides basic statistical data about the governorate and hospital.

Table 1. Snapshot of Irbid Governorate and Princess Raya Hospital in 2001

Irbid Governorate	
Total population in governorate:	835,360
Unemployment rate:	28.6%
Insured workers:	59.2%
Comprehensive clinics:	5
Primary health clinics:	43
Peripheral clinics:	14
Maternal and child clinics:	35
Princess Raya Hospital	
Hospital Director:	Dr. Ahman Al-Shaqran
Physical size (m ²):	7,000m ²
Land area (m ²):	47,000m ²
Occupancy rate:	77%
Bed size:	64
Admissions:	5,939
Outpatient visits:	60,618
Emergency room visits:	45,887
Average length of stay:	3.1 days
Inpatient days:	16,948
Patient coverage:	
Percent MOH (Civil Insurance Program):	19.5%
Percent RMS:	61.0%
Percent uninsured	17.8%
Staff:	
Administrative/Finance:	21
Physicians:	34
Nurses/Midwives:	113
Pharmacists:	10
Technical:	35
Other:	21

1.3 Organization of This Report

This document is divided into six chapters. Chapter 2 provides an overview of the basic concepts and methodology of hospital costing. Chapter 3 describes the methods for estimating variable input costs as well as the cost estimates themselves. Chapter 4 presents Princess Raya's fixed costs estimates, and Chapter 5 contains the estimation of total hospital costs. Chapter 6 provides policy implications and conclusions.

2. Background on Hospital Cost Analysis

2.1 Basic Concepts of Hospital Costing

Over the past 30 years a vast literature has described theoretical and empirical aspects of methodologies for conducting economic analyses of hospital costs. Prominent among these studies is the seminal work that was conducted by Feldstein (1967), and Carr and Feldstein (1967), which describes the production process of the hospital in terms of the economic behavior of a multi-product firm. More recent work in this area includes that of Breyer (1987), Cowing and Holtmann (1983), Granneman, Brown, and Pauly (1986), and Vita (1990). While the vast majority of this work over the past 30 years focused on the economic behavior of hospitals in developed economies, a more recent work by Barnum and Kutzin (1993) examined the developing country context. The hospital costing work that was conducted at Princess Raya hospital emanates from this rich body of literature.

Economists define the economic costs of an institution in two ways. In the first, economic costs are defined as the “market value” of all inputs (both variable and fixed) that are utilized during the production process. Alternatively, economic costs are defined as the market value of inputs in their next best alternative use (Binger and Hoffman, 1988). This latter definition is most often associated with contemporary approaches to economic cost analysis, in that it directly associates with the concept of opportunity costs. For example, when economists estimate the cost of fixed capital inputs they consider not only the cash outlay, but also the fact that those funds alternatively could have been invested in an interest earning bank account. In Jordan, anecdotal evidence suggests that current Ministry of Health procurement policies provide some MOH hospitals with equipment for which they have no use. Such idle equipment imposes a cost to the government, in that the money used to purchase the equipment might have been invested in an interest bearing account, or used to purchase needed equipment. Hence, the total cost to the hospital for the purchase of the unneeded equipment is the sum of the explicit costs (i.e., the cash payment) and the implicit costs (e.g., the forgone interest payment). It is this distinction between explicit and implicit costs that differentiates an economic cost analysis from an accounting or financial cost analysis, which would consider only the explicit costs.

In order to estimate the total economic costs of operating Princess Raya hospital, the various inputs utilized to produce the array of hospital services were divided into two categories: variable inputs and fixed inputs (see also Annex A). Economists refer to each of these inputs as “factors of production.” Each is described below:

- ▲ *Variable Inputs* (Variable Factors of Production): Variable inputs are those factors of production whose quantity varies with the level of output. For a hospital, the most common variable input is the labor it employs, i.e., the numbers of nurses, doctors, and ancillary personnel that are optimal for the size of their patient populations. Other variable factors are butane gas, electricity, and medical consumables, which also vary with the number of patients treated. However, it is not uncommon for hospitals in developing economies, such as Jordan, to have labor categories that are constrained by government regulatory policies. In Jordan, MOH and Civil Service rules allow certain labor categories in MOH facilities to be more variable (flexible) than others. For example, MOH hospital directors have greater

freedom to alter nursing labor input than they do physician labor input. In still other systems, i.e., command economies such as many of the former Soviet Republics, labor assumes the economic behavior of a fixed factor of production. In other words, various categories of labor may be variable, semi-variable, or quasi-variable.

- ▲ **Fixed Inputs (Fixed Factors of Production):** Fixed inputs are those factors of production that cannot be readily changed as the quantity of service production increases or decreases. Examples are capital inputs such as large medical equipment and the hospital structure itself. Costs that are associated with such fixed factors are often referred to as “sunk costs.”

Economic costs are estimated according to two “temporal” dimensions: the long-run and the short-run. These dimensions, however, refer less to a defined period of time and more to the way a hospital can treat the various factors of production. For example, long-run cost estimations assume that all factors of production are variable; hence, the hospital has significant flexibility in altering its labor/capital mix. Alternatively, short-run cost estimates assume that at least one factor of production remains fixed throughout the production process. The current study – a single case, Princess Raya hospital, for a defined period of time, 1999 – is a short-run cost estimation.¹ Such short-run estimations adhere to the following set of economic principles:

- ▲ **Total Variable Costs (VC):** Total variable costs are the sum of the costs of variable factors of production. A few examples are labor, utility, structure and equipment, and nonclinical supplies. Chapter 3 discusses these costs at Princess Raya hospital.
- ▲ **Total Fixed Costs (FC):** Total fixed costs are the sum of the costs of the various fixed factors of production. Chapter 4 estimates the total costs of such factors, examples of which are structure, vehicle, equipment, and furniture.
- ▲ **Total Cost (TC):** Total costs are the summation of total variable costs and total fixed costs. Unlike variable factors of production, the costs of fixed factors must be considered in terms of their annualized depreciation costs, as well. As stated previously, this report estimates short-run total costs, given the existence of fixed factors of production.
- ▲ **Average Variable Costs (AVC):** Average variable cost is the ratio of total variable costs to a particular output category. Several AVC combinations can be estimated for hospitals, because a hospital can be viewed as a multi-product institution. Several standard output proxies capture this multi-product nature of hospital services production. The output proxies that were utilized in this study are inpatient days (both adjusted and unadjusted), admissions (both adjusted and unadjusted), bed-days, patients, and visits. The most commonly estimated AVC is the ratio of total variable costs to total inpatient days.
- ▲ **Average Fixed Costs (AFC):** Average fixed cost is the ratio of total fixed costs to a particular output category. The hospital as a multi-product institution is relevant to AFCs as well as to AVCs. Hence, AFC estimations can be considered within the context of the various output proxies mentioned above.

¹ Long-run cost functions are typically estimated through the employment of time-series data for a statistically significant sample of facilities.

- ▲ **Average Total Costs (ATC):** Average total cost is the ratio of total costs to a particular output category. Again, the multi-product nature of the hospital allows for various ATC estimates to be obtained, depending upon the category of output utilized in the numerator.

There is one additional common and most important category of cost: marginal costs. Marginal cost is the change in total costs over a defined time period, relative to a particular output category. Estimating marginal costs of a particular output requires data on unit costs from at least two time periods. In cross-sectional studies, such as the current study, which uses data from a single period of time, marginal costs estimates are unobtainable.

2.2 Basic Methodology

With the oversight of the Hospital Decentralization Implementation Team and using a detailed list of all services offered by Princess Raya hospital (see Annex A for an inventory of services), the hospital workgroups divided the services into two major “cost center” categories: Daily Hospital Services and Ancillary and Support Services. Once agreement was reached on the two broad classifications, the workgroups further divided the services into cost center subcategories. Under Daily Hospital Services, services that require similar labor and capital inputs and that treat patients with similar maladies were grouped into a single cost subcategory; those that require distinctly different inputs and treatment patterns were classified separately. For example, the Surgery cost center includes urological, gastrointestinal, ophthalmic, and other categories of general surgery, as well as its subspecialties. Intensive care surgical, coronary, and burn services were placed in the Intensive Care Unit/Critical Care Unit (ICU/CCU) cost center. Other cost centers include: Obstetrics/Gynecology (OB/GYN), Internal Medicine, Operating Room (OR), Pediatrics, Emergency Room (ER), and Outpatient Clinic departments.

Ancillary and Support Services comprises Administration/Finance, Rehabilitation, X-ray, Laboratory, Pharmacy, and Food and Beverage departments. As with Daily Hospital Services, cost center subcategories were determined based upon their inputs, as well as the outputs (services) that they perform in support of the hospital’s overall function.

Once the cost centers were defined, the workgroups and Implementation Team created a detailed list of variable and fixed factors that are utilized by the hospital. The variable factors, and the methodology employed to estimate their costs are summarized below and detailed in Chapter 3.

- ▲ **Labor:** This includes compensation paid to medical doctors, nurses/midwives, pharmacists, and administrative, finance, technical/medical, technical/nonmedical, and other personnel. An accurate list of employees who worked at the hospital was matched against MOH personnel records, which detailed the level of compensation for each employee. Chapter 3 details the allocation rule used to distribute the employees labor costs among various hospital “cost centers.”
- ▲ **Nonlabor Variable Factors:** this variable input was divided into five specific categories: utility inputs, structure and equipment inputs, consumable inputs, contracted services, and nonclinical supplies. Utility inputs include fuel, butane gas, telephone services, electricity and water. Structure and equipment inputs include building renovations, rental unit for nurses’ quarters, building maintenance and renewal, equipment maintenance and supplies. Consumable inputs include drugs and medications, gases, medical consumables, and laboratory and radiological consumables. Contracted services include food services, housekeeping services, laundry services, and other contracted services. Nonclinical supplies

include stationeries, textiles and linens, and perishables. Chapter 3 details the allocation rule employed to distribute such costs across the various hospital cost centers. For example, butane gas use was distributed among cost centers according to the proportion of square meters of physical space that the cost center occupies, based on hospital blueprints and construction documents obtained from the MOH Department of Buildings.

The fixed factors, and the methodology employed to estimate and distribute their costs among the cost centers is contained in Chapter 4. The fixed factors employed by Princess Raya hospital during the period of this study are listed below:

- ▲ **Fixed Hospital Structure:** the hospital building, electrical structures, sewage and plumbing structures, and kidney dialysis unit.
- ▲ **Hospital Vehicles:** tankers, buses, sedans, ambulances, and pickup trucks.
- ▲ **Equipment and Furniture:** medical equipment and hospital furniture. Equipment and furniture costing JD 100 (US\$140) is listed in Annex C.

Variable and fixed factors were distributed among the various hospital cost centers according to the allocation rules that are summarized in Tables A1–A3 of Annex A.

3. Accounting for Variable Input Costs

This chapter presents cost estimates for the various labor and nonlabor cost categories at Princess Raya hospital. It also discusses the rules utilized for dispersing the costs to the various hospital cost centers.

3.1 Labor Costs Estimations

As discussed in Chapter 2, the cost of labor is the major contributor to hospitals' variable costs. At Princess Raya hospital, labor was grouped into eight categories: medical doctors, nurses/midwives, pharmacists, and administrative, finance, technical/medical, technical/nonmedical, and "other."

In Jordan, employee remuneration, paid in cash by the Ministry of Health, consists of three identifiable components: wages, incentives (bonuses), and transportation.² The distribution of these components varies by employee classification and entitlements. For example, all physician personnel within the MOH are eligible for "incentive" payments, which are largely determined by category and class.

The study took the following steps to derive the cost of labor at Princess Raya hospital.

- ▲ It first obtained from the hospital an accurate list of all employees in 1999.
- ▲ Using employee ID numbers, it then checked the hospital list against monthly compensation records obtained from the MOH Division of Accounting and Finance.
- ▲ Total annual compensation paid to employees for work directly related to Princess Raya hospital was obtained from the division and checked against the hospital's records, and used in the analysis.

As shown in Table 2, the hospital's labor costs for 1999 totaled JD 764,616. In nominal terms the most costly labor input was the nursing staff (registered nurses, nurse assistants, and midwives), JD 290,422 (\$490,495), followed by physician labor, JD 254,260 (\$358,507).

² Under optimal costing rules payroll-related employee benefits – sick leave, paid holidays, paid vacations, and maternity leave – would be accounted for. However, given the existing system of documentation within the MOH, estimating the costs of these benefits would have necessitated the study to exceed its time constraints.

Table 2: Labor Costs, by Employee Category (in JD)

Labor Categories	Salaries	Incentives	Transportation	Total L _c
Medical Doctors	JD 221,165	JD 28,435	JD 4,660	JD 254,260
Nurses/Midwives	290,422	--	--	290,422
Pharmacists	27,852	737	598	29,187
Administrative	33,405	--	--	33,405
Finance	20,506	--	--	20,506
Technical/Medical	73,555	--	--	73,555
Technical/Nonmedical	17,225	--	--	17,225
Other	46,056	--	--	46,056
Total	JD 730,186	JD 29,172	JD 5,258	JD 764,616

Note: Administration includes medical records personnel, administrative assistants, personnel, and photocopying staff; technical/medical includes laboratory technicians, x-ray technicians, nutrition technicians, physical therapists, and anesthesiology technicians; technical/nonmedical includes maintenance personnel; "other" includes telephone operators, drivers, security, and tailors.

Table 3 lists the total number of Princess Raya personnel and their per unit labor costs. In addition, it converts the total number of employees into full-time equivalent (FTE) estimates. The MOH does not compile information on the productive and nonproductive hours worked by employees. The FTEs here (*hypothetical*-FTEs, or *h*-FTEs) begin to allow for nonproductive hours by looking at paid holidays per year to which all hospital employees are entitled.

Table 3: Labor Costs in Full-time Equivalents, by Employee Category

Labor Categories	Numbers	FTE Hours	<i>h</i> -FTE	Total Costs	L _c per Unit (per FTE)
Medical Doctors	34	81,328	31	JD 254,260	JD 7,478 (JD 8,202)
Nurses/Midwives	113	211,536	102	290,422	2,570 (2,847)
Pharmacists	10	18,720	9	29,187	2,919 (3,243)
Administrative	14	26,208	13	33,405	2,386 (2,570)
Finance	7	13,104	6	20,506	2,929 (3,418)
Technical/Medical	29	54,288	26	73,555	2,536 (2,829)
Technical/Nonmedical	6	11,232	5	17,225	2,870 (3,445)
Other	21	39,312	19	46,056	2,193 (2,424)
Total	234	455,728	211	JD 764,616	JD 3,268 (JD 3,624)

As illustrated in Table 3, when one accounts for the “nonproductive” holiday hours, it appears that Princess Raya hospital is operating with no more than 211 FTE employees, instead of the 234 noted in employee lists. One physician FTE puts in 2,392 hours per year; for other worker categories one FTE is 1,872 hours per year. Study estimates are based on these FTE numbers.³

It should be noted that even this FTE number fails to account for the additional nonproductive hours of employee sick leave and vacation time. A more accurate FTE estimate would take each of these into account; however, such an effort was outside the scope of this study. In short, it is important that Princess Raya hospital begin to implement an effective system of compiling employee work hours that differentiates productive from nonproductive time. A follow-on study of hospital worker productivity would form an excellent forum for such an analysis.

Table 4 depicts the percent distribution of employees in each labor category, and the proportion of labor costs consumed by each category. As the table shows, each category’s labor costs are quite proportionate to their input distribution. Approximately 48.3 percent of all employees are classified as nurses (both registered nurses and nursing assistants) or midwives. Their share of labor costs amounts to approximately 38 percent of the total. The next largest category is that of physician personnel, at 14.5 percent of labor input and 33.2 percent of labor costs. Pharmacists and their assistants account for roughly 4.3 percent of hospital-based personnel and 3.8 percent of labor costs. Administrative/finance and technical personnel represent 9 percent and 15 percent of input, and 7.1 percent and 11.8 percent of costs, respectively.

Table 4: Percent Distribution of Labor Costs, by Employee Category

Labor Categories	Percent of Personnel	Percent of Lc
Medical Doctors	14.5%	33.2%
Nurses/Midwives	48.3%	38.0%
Pharmacists	4.3%	3.8%
Administrative	6.0%	4.4%
Finance	3.0%	2.7%
Technical/Medical	12.4%	9.6%
Technical/NonMedical	2.6%	2.2%
Other	9.0%	6.0%
Total	100.0%	100.0%

Table 5 presents the distribution of personnel by hospital cost center. Of the two broad categories (Daily Hospital Services and Ancillary and Support Services), the larger share, 63 percent, is employed by cost centers that are directly involved in the provision of daily hospital services. Four of these cost centers account for 66 percent of daily hospital services costs: Surgery and Obstetrics/Gynecology, each at 16 percent, and Emergency Room, and Operating Room, each at 17 percent. Thirty-seven percent of hospital personnel provide ancillary and support services, with approximately 31 percent of them assigned full-time to administrative tasks.

³ Once the FTE hours were calculated, the total number of hours of paid government holidays per year were subtracted from the FTE hours for each labor category. The net figure obtained was then divided by the total number of FTE hours, to obtain the FTE estimate.

Table 5: Labor Distribution by Cost Center

Cost Center	Physicians	Nurses/Midwives	Other Personnel	Total Personnel
Daily Hospital Services				
Surgery	10	14	--	24
OB/GYN	5	19	--	24
Internal Medicine ¹	4	12	--	16
Emergency Room	6	20	--	26
ICU/CCU ²	--	6	--	6
Operating Room	2	15	9	26
Pediatrics	6	10	--	16
Outpatient Clinics	NB ³	12	--	12
Subtotal	33	108	9	150
Ancillary & Support Services				
Admin/Finance	NB	2	26	28
Rehabilitation	--	--	2	2
X-ray Services	1	--	9	10
Laboratory Services	--	--	7	7
Pharmacy Services	--	--	10	10
Food & Beverage	--	--	2	2
Other	--	4	21	25
Subtotal	1	6	77	84
Total	34	114	86	234

Note: "Other" category includes centers that are affiliated with sterilizing small medical equipment and devices.

¹Internal Medicine includes physician time spent doing rounds of patients in the ICU (researchers were unable to disaggregate this component of physician time).

²Princess Raya ICU is staffed by full-time nursing staff only.

³NB indicates that this is a secondary task that is covered by physician staff. For example, all physician staff must spend a small number of hours per week in the Outpatient Clinics. Hence, to avoid double counting, such part-time assignments are not counted as their primary task.

Table 6 allocates labor costs, by cost center. In order to be consistent with hospital costing rules, all payroll-related expenses incurred by employees must be charged to the relevant cost centers. Incentives (bonuses), severance pay, and benefits are typically charged to such centers. However, as was previously stated, due to data constraints and MOH accounting rules, this study was unable to provide a reasonable estimate of severance pay and other benefits. Hence, a simple allocation rule was employed to allocate labor costs among intermediate and direct services, according to staffing patterns and employees' responsibilities. The following allocation rule was employed:

- ▲ Employees were categorized by the cost center in which they worked.
- ▲ If an employee worked in more than one center, his/her labor remuneration was apportioned among each center as determined by the percentage of time allocated to each. Hence, employees conducting outpatient, inpatient and administrative services for the hospital would have their salaries apportioned among categories, according to the percentage of hours dedicated to each service category.

Table 6: Labor Costs by Cost Center

Cost Center	Salaries	Incentives	Transportation	Total Costs
Daily Hospital Services				
Surgery	JD 88,041	JD 3,465	JD 797	JD 92,303
OB/GYN	68,919	2,888	480	72,287
Internal Medicine ¹	39,954	3,545	836	44,335
Emergency Room	59,218	--	--	59,218
ICU/CCU ²	14,875	--	--	15,245
Operating Room	85,563	4,438	718	90,719
Pediatrics	58,676	4,449	474	63,599
Outpatient Clinics	81,977	7,267	875	90,119
Subtotal	497,223	26,052	4,180	527,825
Ancillary & Support Services				
Admin/Finance	139,347	1,668	480	141,495
Rehabilitation	4,618	--	--	4,618
X-ray Services	29,583	715	--	30,298
Laboratory Services	18,416	--	--	18,416
Pharmacy Services	27,852	737	598	29,187
Food & Beverage	2,295	--	--	2,295
Other	10,482	--	--	10,482
Subtotal	232,963	3,120	1,078	237,161
Total	JD 730,186	JD 29,172	JD 5,258	JD 764,616

Note: Other category includes centers that are affiliated with sterilizing small medical equipment and devices.

¹Includes physician time spent doing ICU rounds (researchers were unable to disaggregate this component of physician time).

²Princess Raya ICU is staffed by full-time nursing staff only.

Princess Raya hospital incurred JD 764,616 in payroll expenses in 1999. As indicated in Table 6, 69 percent of that amount (JD 527,825) was allocated to the provision of daily hospital services. Surgery, OR, and Outpatient Clinics accounted for approximately 17 percent of the labor costs associated with the delivery of those services. OB/GYN, Pediatrics, and ER accounted for 14 percent, 12 percent, and 11 percent, respectively. Of the 31 percent (JD 237,161) of labor cost allocated to ancillary and support services, 60 percent was consumed by administrative and financial services. In fact, these services account for the single largest component of overall hospital labor expenses, roughly 19 percent.

3.2 Labor Costs Per Unit Output

Table 7 lists labor costs per unit of output (patient days), one of several flow variables employed in this study. As is typically the case, a patient (census) day includes the day of admission but not the

day of discharge or death. Other information contained within this section is number of bed days,⁴ visits,⁵ and hospital occupancy rates,⁶ by cost center. In addition, the total number of adjusted patient days⁷ was estimated, by employing a case-mix proxy, to account for variations in patients treated across hospital cost centers. This allows for a more accurate comparison of per-unit labor costs across centers. As illustrated in Table 7, Internal Medicine has the highest adjusted and unadjusted labor cost per patient day, JD 44 and JD 30, respectively. A more informative comparison, across centers, is conducted later in this section as per-unit costs in terms of total variable costs are considered.

Table 7: Total Labor Costs by Cost Center, Patient Days, Patients, and Adjusted Patient Days

Cost Center	Patient Days	Patients	Adjusted Patient Days	Labor Costs	Lc per Patient Day (Per Adj. Patient Day)
Daily Hospital Services					
Surgery	5,123	1,637	5,023	JD 92,303	JD 18 (JD 18)
OB/GYN	6,092	2,572	7,912	72,287	12 (9)
Internal Medicine ¹	1,518	328	1,005	44,965	30 (44)
ICU/CCU ²	651	202	620	15,245	23 (25)
Pediatrics	3,564	804	2,458	63,599	18 (26)
Total	16,948	5,543	17,018	JD 288,399	JD 17 (JD 17)

¹Includes physician time spent doing ICU rounds.

²Only includes nursing staff labor expenditures.

Table 8 distributes labor costs by bed days across the various hospital cost centers. Surgery exhibits the highest cost per bed day. Table 8 also provides information on the overall hospital occupancy rate (77 percent), as well as the occupancy rate for each inpatient department. It is of import to note that the occupancy rates for the Surgery and OB/GYN departments include patients that are categorized as “day service” patients. Such patients may occupy an inpatient bed for up to 23 hours, from their time of admission. These patients are categorized as inpatients by the hospital; however, a more appropriate classification would be “outpatient, day-surgical” or “outpatient, day-obstetrics/gynecology” patients.

⁴ Bed day = [(number of licensed beds x number of days in the reporting period)]. Number of licensed beds are the official number of MOH-approved beds; the reporting period is the period of this study 1 January 1999 to 31 December 1999.

⁵A “visit” is defined as the appearance of a patient at the hospital for ancillary or ambulatory treatment.

⁶ Occupancy rate = [(patient days/bed days)]

⁷ Adjusted Patient Day = [(patient days)/(group-average length of stay (alos)/population-alos)]

Table 8: Total Labor Costs by Cost Center, Bed Days, and Occupancy Rate

Cost Center	Bed Days	Patient Days	Lc per Bed Day	Occupancy Rate
Daily Hospital Services				
Surgery	4,745	5,123	JD 19	107%
OB/GYN	5,110	6,092	14	119%
Internal Medicine ¹	4,380	1,518	10	35%
ICU/CCU ²	1,460	651	10	45%
Pediatrics	6,205	3,564	10	57%
Total	21,900	16,948	JD 13	77%

¹Includes physician time spent doing ICU rounds.

²Only includes nursing staff labor expenditures.

Table 9 list labor costs per admissions and adjusted admissions.⁸ Unlike a patient day, which typically pertains to a full day of hospitalization, a patient may be admitted and then discharged prior to completing a full day of treatment. Hence, this variable is often considered a flow variable that captures the input costs associated with treating an average case, irrespective of the patient's hospital stay. Moreover, patients may be admitted into a particular cost center and then transferred to another.

Table 9: Labor Costs by Cost Center, Admissions, and Adjusted Admissions

Cost Center	Admissions	Adjusted Admissions	Labor Costs (Lc)	Lc per Admission	Lc per Adj. Admission
Daily Hospital Services					
Surgery	1,761	1,726	JD 92,303	JD 52	JD 53
OB/GYN	2,688	3,491	72,287	27	21
Internal Medicine ¹	371	246	44,965	121	183
ICU/CCU ²	222	211	15,245	69	72
Pediatrics	897	619	63,599	71	103
Total	5,939	6,293	JD 288,399	JD 49	JD 46

¹Includes physician time spent doing ICU rounds.

As illustrated in Table 9, the highest labor cost per admission, adjusted and unadjusted, is within the Internal Medicine department (JD 183 per adjusted admission). However, as previously mentioned, considering labor a cost within this context is primarily for illustrative purposes, given that labor costs are only one component of variable inputs. Other variable inputs include utilities, gases, renovations, and contracted services. Hence, a more informative method of comparing costs across centers is the total variable costs of production, and the relevant per-unit costs, which is done later in this report.

Table 10 allocates physician labor costs among hospital cost centers according to physician labor distribution throughout the inpatient, outpatient, and ancillary departments. It is not unusual for a

⁸ Adjusted Admission = [(admissions)/(group-alos/population-alos)]

physician's work hours to be allocated to more than one cost center. For example, the hospital director at Princess Raya hospital may also be a hospital-based pediatrician. As a result, his total labor cost to the hospital is allocated to both administrative and clinical cost centers. As is true throughout this study, the costs in Table 10 include the three major components of physician remuneration: salaries, incentives, and transportation.

Table 10: Distribution of Total Physician Labor Cost, by Cost Center

Cost Center	Salaries	Incentives	Transportation	Lc
Daily Hospital Services				
Surgery	JD 20,429	JD 3,465	JD 797	JD 24,691
OB/GYN	20,980	2,888	480	24,348
Internal Medicine ¹	26,238	3,545	836	30,619
Emergency Room	19,430			19,430
Operating Room	26,516	4,438	718	31,672
Pediatrics	32,893	4,449	474	37,816
Outpatient Clinics	60,222	7,267	875	68,364
Subtotal	206,708	26,052	4,180	236,940
Ancillary & Support Services				
Administration/ Finance	8,232	1,668	480	10,380
X-ray Services	6,225	715		6,939
Subtotal	14,457	2,383	480	17,319
Total	JD 221,165	JD 28,435	JD 4,660	JD 254,260

¹Includes physician time spent doing ICU rounds.

As Table 10 shows, in nominal terms, physician labor costs that are associated with the provision of outpatient services (JD 68,364) constitute the largest category of physician remuneration (27 percent), as a function of the amount of time allocated towards the provision of a particular service category. This is followed by OB/GYN and Pediatrics, each of which accounts for 10 percent of total physician costs. Roughly 4 percent of physician labor costs is associated with the provision of administrative and financial services, primarily with the duties of hospital director.

Table 11 shows the allocation of physician labor costs to the various cost centers that are engaged in the delivery of daily hospital services. Labor cost per patient day and adjusted patient day were estimated. The highest physician labor cost (both adjusted and unadjusted) is found within the Internal Medicine department. Anecdotal evidence suggests that this department is overstaffed; hence, we suspect this result to be driven by the staffing patterns at the hospital. However, this cannot be substantiated until further studies of labor productivity within the hospital are performed.

Table 11: Distribution of Physician Labor Cost by Cost Center, Patients, Patient Days, and Adjusted Patient Days

Cost Center	Patient Days	Patients	Lc	Lc Per Patient Day	Lc Per Adj. Patient Day
Daily Hospital Services					
Surgery	5,123	1,637	JD 24,691	JD 5	JD 5
OB/GYN	6,092	2,572	24,348	4	3
Internal Medicine ¹	1,518	328	30,619	20	30
Pediatrics	3,564	804	37,816	11	15
Total	16,297	5,341	JD 117,474	JD 7	JD 7

¹Includes physician time spent doing ICU rounds.

Table 12 allocates the largest labor costs component, nursing cost, among the various hospital cost centers. As noted above, the cost estimates include all nursing categories: registered nurses, nursing assistants, and nurse midwives. Nurses are currently ineligible for Ministry of Health incentives (bonuses), and they received no transportation allowances during the period of this study. Hence, the sole component of nursing labor remunerations in 1999 was their salary compensation. The highest category of nursing labor cost is that associated with the delivery of surgical services, JD 62,417, or 21 percent of total nursing remuneration. The second largest category of nursing labor, is found in the OB/GYN department, JD 47,938, or 17 percent.

Table 12: Distribution of Nursing/Midwives Labor Costs, by Cost Center

Cost Center	Salaries	Number Nurses/Midwives	Cost per Unit of Nursing Labor
Daily Hospital Services			
Surgery	JD 62,417	14	JD 4,458
OB/GYN	47,938	19	2,523
Internal Medicine	13,157	12	1,096
Emergency Room	39,787	20	1,989
ICU/CCU	15,244	6	2,541
Operating Room	39,640	15	2,643
Pediatrics	25,777	10	2,578
Outpatient Clinics	21,759	12	1,813
Subtotal	265,719	108	2,460
Ancillary & Support Services			
Administration	7,284	2	3,642
Other	17,419	4	4,355
Subtotal	24,703	6	4,117
Total	JD 290,422	114	JD 2,548

Note: "Other" category includes centers that are affiliated with sterilizing small medical equipment and devices, also includes personnel assigned to the Nursing Development Center.

Table 12 also considers the per unit cost of nursing labor that is involved in the delivery of daily hospital services. The highest per-unit nursing cost is found within the Surgery department (JD 4,458), followed by OR, Pediatrics, ICU/CCU, and OB/GYN. This higher per-unit compensation for surgical nurses is expected, given that they constitute some of the most highly trained nurses in the hospital.

Table 13 allocates nursing labor costs by cost center, patient days, and adjusted patient days. The highest nursing labor costs per adjusted inpatient day are found in the ICU/CCU departments. This is expected, given that ICU/CCU patients are the most ill of all patients within the hospital. As such, they require more intensive nursing labor inputs per patient treated.

Table 13: Distribution of Nurses/Midwives Labor Cost by Cost Center, Patients, Patient Days and Adjusted Patient Days

Cost Center	Patient Days	Patients	Lc	Lc Per Patient Day	Lc Per Adj. Patient Days
Daily Hospital Services					
Surgery	5,123	1,637	JD 62,417	JD 12	JD 12
OB/GYN	6,092	2,572	47,938	8	6
Internal Medicine	1,518	328	13,157	9	13
ICU/CCU	651	202	15,244	23	25
Pediatrics	3,564	804	25,777	7	10
Total	16,948	5,543	JD 164,533	JD 10	JD 10

Table 14 estimates combined total physician and nursing labor costs, and looks at them relative to the hospital's patient days and adjusted patient days. The highest labor cost center per adjusted patient day is the Internal Medicine department. This is due primarily to the number of highly trained health care personnel (physicians and nurses) that are assigned to this department. For example, when one considers the information contained in Tables 5 and 14, the number of patients per health care worker in the Internal Medicine department is much lower (21 patients per health care worker), than that of other departments, indicating a higher concentration of labor. Conversely, OB/GYN, Surgery, and Pediatrics exhibit ratios of 107, 68, and 50 patients per health care worker, respectively.⁹

⁹ This difference is likely due to case-mix differences among cost centers.

Table 14: Distribution of Physician and Nurse/Midwife Labor Cost (L_{pn}) by Cost Center, Patients, Patient Days, and Adjusted Patient Days

Cost Center	Patient Days	Patients	L_{pn} ($L_p + L_n$)	L_{pn} Per Patient Day	L_{pn} Per Adj. Patient Day
Daily Hospital Services					
Surgery	5,123	1,637	JD 87,108	JD 17	JD 17
OB/GYN	6,092	2,572	72,287	12	9
Internal Medicine	1,518	328	43,776	29	43
Pediatrics	3,564	804	63,593	18	25
Total	16,297	5,543	JD 266,764	JD 16	JD 16

A startling result is that the number of patients treated per OB/GYN health care worker is more than five times that of Internal Medicine, and significantly more than that of Surgery and Pediatrics. In fact, as illustrated in Table 15, the average product of labor for OB/GYN is significantly higher than other departments, 330 adjusted patient days per labor input.¹⁰ Hence, taking into account the information contained in Tables 7 and 15, it appears that the OB/GYN department is a low-cost and high-product department, relative to others. Conversely, Internal Medicine represents a high-cost and low-product department, relative to others. Its labor cost of JD 44 per adjusted patient day, coupled with its relatively low average product of labor (63 adjusted patient days per unit) suggest that further research into the hospital's labor policies within this department be conducted.

Table 15: Average Product of Labor Estimations, by Hospital Cost Center

Cost Center	Patient Days	Adjusted Patient Days	Labor Units	Average Product (Days/Unit)	Average Product (Adj.Days/Unit)
Daily Hospital Services					
Surgery	5,123	5,023	24	213	209
OB/GYN	6,092	7,912	24	254	330
Internal Medicine	1,518	1,005	16	95	63
ICU/CCU	651	620	6	108	103
Pediatrics	3,564	2,458	16	223	154
Total	16,297	17,018	86	190	198

Finally, when one considers that Princess Raya hospital delivered 2,202 newborns during the period examined by this study, the OB/GYN labor cost was roughly JD 33 per delivery.

¹⁰ Given that the capital input of the hospital is assumed fixed in the short-run, it is possible to estimate a point on the hospital's short-run expansion path for its variable factor (labor). Hence, the ratio of its total product of labor to the number of labor units employed yields the hospital's average product of labor. A more comprehensive estimate would have entailed the calculation of total productive hours. This would have yielded a more precise estimate of average product by department. However, as explained above, study researchers were precluded from such estimations given the lack of data on productive and nonproductive hours.

The next section will consider additional variable factors that are utilized in the production of hospital services. These factors, coupled with the hospital's labor input, provide a comprehensive estimate of the total variable cost for producing hospital services at Princess Raya in 1999.

3.3 Nonlabor Variable Factors of Production

Nonlabor variable factors of production include utilities (fuel, butane gas, telephone, electricity, and water); structure and equipment (building renovations, housing quarters, building maintenance and renewal, equipment maintenance and supplies); consumables (drugs and medications, gases, medical consumables, laboratory and X-ray consumables); contracted services (food services, housekeeping, laundry, other); and other (stationeries, textiles and linen, perishables). Expenditure information on each was obtained from the MOH Directorates of Supplies and Procurement and Building Maintenance, and other agencies.

Table 16 lists the utility cost estimates. Total utility costs were obtained from the MOH Accounting Division, as well as the hospital's accounting department. Using hospital blueprints obtained from the Ministry of Planning (MOP) and the MOH Department of Buildings, a step-down method was employed to distribute fuel, butane, electrical, and water expenses among costs centers within the hospital, relative to their proportion of the structure's square meters. Telephone expenditures were estimated similarly; however, the allocation rule entailed distributing costs based upon the proportion of telephone lines available within a given cost center.

Table 16: Utility Costs Estimates

Utilities	Total Costs
Fuel	JD 13,308
Butane Gas	3,152
Telephone Services	6,802
Electricity	30,495
Water	15,000
Total Utility Costs	JD 68,757

Table 17 lists the variable structure and equipment estimates. The costs of building renovations and building maintenance were obtained from the MOH Directorate of Building Maintenance and the Directorate of Planning and Projects. Other building maintenance costs and costs of building supplies were obtained from the hospital's accounting records and the MOH Accounting Division.

Table 17: Variable Structure and Equipment Estimates

Structure and Equipment	Total Costs
Building Renovations	JD 925
Rental Unit for Nurse's Quarters	4,500
Building Maintenance and Renewal	87,201
Equipment Maintenance and Supplies	50,000
Total Structure and Equipment	JD 142,626

Table 18 lists the various medical consumables. The costs of drugs, gases, and other medical consumables, as well as laboratory and radiological consumables were obtained from the MOH Directorate of Supplies and Procurement, and the MOH Central Drug Directorate. Drugs and other consumable prices were estimated according to price per unit. Drugs and medical consumables consumption was allocated across cost centers using a survey designed by the Hospital Decentralization Implementation Team. Princess Raya hospital did not employ a drug consumption tracking system prior to the implementation of this study. The survey tracked the distribution of drugs from the pharmaceutical department to the various costs centers over a period of 60 days. The costs of gases were distributed across each cost center based upon the proportion of cylinder connections operating within each center.

Table 18: Variable Hospital Consumables

Consumables	Total Costs
Drugs and Medications	JD 178,816
Gases	6,304
Medical Consumables	82,006
Laboratory and Radiology Consumables	33,316
Total Consumables	JD 300,442

Table 19 lists the various hospital-based services contracted to the private sector. Contracted services are negotiated at the central ministry level, and a single contractor is responsible for providing the indicated services to all 23 MOH hospitals. MOH records of payment for Princess Raya hospital were obtained from the MOH Accounting Division, and compared to those of the contractor, for data verification.

Table 19: Contracted Services

Contracted Services	Total Costs
Food Services	JD 46,368
Housekeeping Services	79,212
Laundry Services	7,728
Other Contracted Services	13,329
Total Contracted Services	JD 146,637

Table 20 lists nonclinical supplies. Estimates for nonclinical supplies were obtained from the Accounting Department at the hospital and the MOH Accounting and Finance Division. They include total expenditure for stationeries, textiles and linen, and perishable items. During the period of this study, the single largest nonclinical supply was perishable items, primarily foodstuffs (JD 80,150).

Table 20: Nonclinical Supplies

Nonclinical Supplies	Total Costs
Stationeries	JD 21,635
Textiles and Linen	10,728
Perishables	80,150
Total Nonclinical Supplies	JD 112,513

3.4 Nonlabor Variable Factors by Cost Center

Employing the aforementioned allocation rules, Table 21 distributes utility costs across hospital cost centers. During the period of this study, the Operating Room exhibited the highest nominal utility costs, JD 9,408, followed by OB/GYN with total utility costs of JD 7,554. High OR utility costs are expected, given the high voltage equipment that an OR typically utilizes. In addition, the OR, with its relatively large and open space, consumes significant amounts of fuel. In 1999, the Princess Raya OR consumed a fuel cost of approximately JD 2,062.

Table 21: Distribution of Utility Cost, by Cost Center

Cost Center	Fuel	Telephone	Electricity	Water	Total Utilities
Daily Hospital Services					
Surgery	JD 1,333	JD 113	JD 2,988	JD 1,469	JD 5,903
OB/GYN	1,687	227	3,781	1,859	7,554
Internal Medicine	280	113	627	308	1,328
Emergency Room	449	227	1,007	495	2,178
ICU/CCU	964	113	2,161	1,063	4,301
Operating Room	2,062	454	4,622	2,270	9,408
Pediatrics	1,136	113	2,546	1,252	5,047
Outpatient Clinics	1,295	1,020	2,902	1,427	6,644
Subtotal	9,206	2,380	20,634	10,143	42,363
Ancillary & Support Services					
Administration	2,177	3,288	4,878	2,399	12,742
Rehabilitation	179	113	399	196	887
X-ray	283	113	1,306	642	2,344
Laboratory	382	113	855	420	1,770
Pharmacy	384	567	860	423	2,234
Food & Beverage	697	227	1,563	775	3,262
Subtotal	4,102	4,421	9,861	4,855	23,239
Total	JD13,308	JD 6,801	JD 30,495	JD14,998	JD 65,602

Table 22 lists other nonlabor variable inputs across hospital costs centers. The Outpatient Clinics incur the highest nonutility variable costs. The primary reason for this is the high level of drug consumption within the outpatient department. In fact, 1999 expenditures on outpatient drug consumption amounted to more than JD 52,500 (approximately 870 fils per visit), roughly 69 percent of total nonlabor variable costs.

Table 22: Distribution of Nonutility Variable Cost (N_c), by Cost Center

Cost Center	Eq. Maint & Supplies	Bldg Maint & Renewal	Contract Services	Drugs	Other Nonutility	Total Nonutility
Daily Hosp Services						
Surgery	JD 3,133	JD 8,995	JD14,367	JD 40,359	JD 2,726	JD 69,580
OB/GYN	5,700	11,383	18,181	18,561	5,160	58,985
Internal Medicine	800	1,888	3,015	9,871	1,489	17,063
Emergency Room	2,609	3,032	4,842	26,983	634	38,100
ICU/CCU	3,799	6,507	10,392	6,884	721	28,303
Operating Room	11,450	13,914	22,224	12,159	3,735	63,482
Pediatrics	3,405	7,665	12,243	11,462	2,487	37,262
Outpatient Clinics	901	8,737	13,956	52,536	81	76,211
Subtotal	31,797	62,121	99,220	178,816	17,033	388,986
Ancillary & Support Services						
Administration	--	14,786	23,458	--	21,635	59,879
Rehabilitation	3,006	1,201	1,919	--	--	6,126
X-ray	8,571	3,933	6,281	--	12,327	31,112
Laboratory	6,625	2,572	4,113	--	20,989	34,299
Pharmacy	--	2,588	4,134	--	82,006	88,728
Food & Beverage	--		7,515	--	83,302	90,817
Subtotal	18,202	25,082	47,420	--	220,259	310,961
Total	JD 50,000	JD 87,201	JD 146,640	JD 178,816	JD 237,292	JD 699,947

Table 23 presents the total variable costs of operating Princess Raya hospital. This amount includes the sum of total labor cost (L_c), total utility cost (U_c) and total nonutility costs (N_c). During the period of this study the total variable costs for Princess Raya hospital amounted to JD 1,519,683. The next section will consider the distribution of this cost, in terms of per unit output. The Outpatient Clinics exhibit the highest variable cost of any center directly involved in the delivery of daily hospital services. Their variable costs are more than 3 percent higher than those of the Surgery department, the second highest cost center. More than 52 percent of the variable cost associated with the provision of clinic services, are the result of the hospital's expenditures on labor input. What is most significant, however, is the amount of variable costs incurred for administrative/financial services (JD 214,116), the largest of any service category. Approximately 66 percent of these variable costs for administrative/financial services are due to labor costs. The implications of this will become more apparent in Chapter 5, which considers administrative/financial costs as a proportion of total hospital costs.

Table 23: Distribution of Total Variable Costs (V_c), by Cost Center

Cost Center	L_c	U_c	N_c	$V_c = L_c + U_c + N_c$
Daily Hospital Services				
Surgery	JD 92,303	JD 5,903	JD 69,580	JD 167,786
OB/GYN	72,287	7,554	58,985	138,826
Internal Medicine ¹	44,335	1,328	17,063	62,726
Emergency Room	59,218	2,178	38,100	99,496
ICU/CCU ²	15,245	4,301	28,303	47,849
Operating Room	90,719	9,408	63,482	163,609
Pediatrics	63,599	5,047	37,262	105,908
Outpatient Clinics	90,119	6,644	76,211	172,974
Subtotal	527,825	42,363	388,986	959,174
Ancillary & Support Services				
Admin/Finance	141,495	12,742	59,879	214,116
Rehabilitation	4,618	887	6,126	11,631
X-ray Services	30,298	2,344	31,112	63,754
Laboratory Services	18,416	1,770	34,299	54,485
Pharmacy Services	29,187	2,234	88,728	120,149
Food & Beverage	2,295	3,262	90,817	96,374
Subtotal	226,309	23,239	310,961	560,509
Total	JD 754,134	JD 65,602	JD 699,947	JD 1,519,683

¹Includes physician time spent rounding on ICU patients (researchers were unable to disaggregate this component of physician time).

²Princess Raya ICU is staffed by full-time nursing staff only.

3.5 Estimations of Per Unit Variable Cost

This section looks at total variable costs (labor and nonlabor) at Princess Raya hospital and at the distribution of these costs relative to the number of patients, patient days, and adjusted patient days.

The total variable costs incurred by Princess Raya are the total costs of utilizing inputs that vary according to the volume of hospital output. As previously explained, hospital output is approximated through the use of various flow variables, typically the number of patient days (adjusted or unadjusted), bed days, patients, admissions, and visits. When total variable costs are considered relative to a particular flow variable, the result is the estimated average variable cost of that variable. The number of hospital beds is occasionally utilized as a flow variable; however, as has been observed in the literature, the use of beds is an inaccurate measure that consistently fails to accurately capture costs effects (Banks, 1993).

Table 24 shows AVCs for five departmental cost centers at Princess Raya hospital. The AVC of in terms of an adjusted patient day in the ICU/CCU is JD 77, the most expensive service in the hospital. However, this amount is not surprising, given the patient population treated within the ICU/CCU. The second highest AVC is for Internal Medicine services (JD 62), followed by Pediatrics, Surgery, and OB/GYN, which incur AVCs of JD 43, JD 33, and JD 18, respectively.

Table 24: Distribution of Total Variable Costs, by Cost Center, Patient Days, and Adjusted Patient Days

Cost Center	Patient Days	Adjusted Patient Days	Total Variable Costs	Average Variable Cost	Adjusted Average Variable Costs
Daily Hospital Services					
Surgery	5,123	5,023	JD 167,786	JD 33	JD 33
OB/GYN	6,092	7,912	138,826	23	18
Internal Medicine	1,518	1,005	62,726	41	62
ICU/CCU	651	620	47,849	73	77
Pediatrics	3,564	2,458	105,908	30	43
Total	16,948	17,018	JD 523,095	JD 31	JD 31

Additional information can be extrapolated from the variable cost data in Table 24. For example, of particular concern to the central ministry are the variable costs associated with the delivery of inpatient care within the OB/GYN department, in particular such costs relative to the number of births that have taken place within that department. It is known that Princess Raya hospital delivered 2,202 newborns in 1999. Given its total variable OB/GYN costs of JD 138,826, that amounted to an AVC of roughly JD 63 per delivery. This cost approximation may be extrapolated to other MOH hospitals, which exhibit similar cost structures.

Table 25 estimates AVC in terms of hospital admissions, both adjusted and unadjusted. The highest AVC is found in the ICU/CCU department. However, when hospital admissions are case-mix adjusted, we find that the highest AVC is in the Internal Medicine department. The lowest AVC, in terms of adjusted admissions, is in the OB/GYN department.

Table 25: Distribution of Total Variable Costs, by Cost Center, Admissions, and Adjusted Admissions

Cost Center	Total Admissions	Adjusted Admissions	Total Variable Costs	Variable Costs Per Admission	Variable Cost Per Adjusted Admission
Daily Hospital Services					
Surgery	1,761	1,726	JD 167,786	JD 95	JD 97
OB/GYN	2,688	3,491	138,826	52	40
Internal Medicine	371	246	62,726	169	255
ICU/CCU	222	211	47,849	215	227
Pediatrics	897	619	105,908	118	171
Total	5,939	6,293	JD 523,095	JD 88	JD 83

Moreover, policymakers often utilize AVC estimates to assess existing cost-sharing rules, relative to the hospital's overall cost structure. For example, in the short run a hospital, like other organizations, should be able to recover its AVCs of production – even if its average fixed costs are “sunk.” Therefore, governments often estimate the AVC for a category of public hospital services and from there estimate the optimal cost-sharing amounts.

Table 26 shows the total number of Emergency Room and Outpatient Clinic visits to Princess Raya hospital in 1999. As defined in Section 3.2, a visit is the appearance of a patient for ambulatory and/or ancillary services. A clinic visit may consist of diagnostic, preventive, curative, and rehabilitative services. An ER visit occurs with the provision of emergency treatment to an ill or injured person, but may also include services to patients who utilize the ER for non-emergency reasons.

Table 26: Distribution of Total Variable Costs, by Emergency Room and Outpatient Visits

Cost Center	Total Visits	Total Variable Costs	Variable Cost Per Visit
Daily Hospital Services			
Emergency Room	45,887	JD 99,496	JD 2.17
Outpatient Clinics	60,618	172,974	2.85
Total	106,505	JD 272,470	JD 2.56

There were 45,887 ER visits, and 60,618 clinic visits. The AVC of an ER visit was JD 2.17 and of a clinic visit, JD 2.85. When one considers this information in terms of the MOH patient cost-sharing rules for non-emergency ER patients, and clinic patients, the cost-sharing implications are quite interesting. For example, the MOH requires ER patients to pay JD 1.65 at the point of services, while it requires clinic patients to pay JD 1.65 and JD .55 for the first and consecutive visits, respectively.

3.6 Distribution of Variable Drug Costs

According to recent National Health Account estimates, Jordanians spent roughly JD 158 million on drugs. This represents to approximately 35 percent of all expenditures on health care services, a substantial amount for any country. In fact, total expenditures on drugs amounted to more than 3 percent of the country's Gross Domestic Product. This makes the costs of drugs within MOH hospitals a paramount concern for policymakers.

Table 27 lists the distribution of drug costs among hospital costs centers. The ICU/CCU department exhibits the highest drug costs per patient, JD 34, roughly 6 percent higher than the cost per surgical patient, (JD 32), the next most costly on a per patient basis. However, the cost per adjusted patient day for ICU/CCU and surgical patients are nearly the same. The lowest drug costs, in terms of patients and patient days, is within the OB/GYN department: JD 7 per patient and JD 2 per patient day. In fact, its drug costs per patient is 100 percent less than the second lowest hospital cost center, pediatrics. In terms of overall patients treated, the hospital's average drug costs amounted to JD 18 per patient, or JD 6 per patient day.

Table 27: Distribution of Drug Costs, by Cost Center, Patient Days, Adjusted Patient Days, and Patients

Cost Center	Total Drug Costs	Number of Patient	Drug Costs Per Patient Day	Drug Costs Per Adjusted Patient Day	Drug Costs Per Patient
Daily Hospital Services					
Surgery ¹	JD 52,518	1,637	JD 10	JD 10	JD 32
OB/GYN	18,561	2,572	3	2	7
Internal Medicine	9,871	328	7	10	30
ICU/CCU	6,884	202	11	11	34
Pediatrics	11,462	804	3	5	14
Total	JD 99,296	5,543	JD 6	JD 6	JD 18

¹Includes drugs used during surgical operations.

The Outpatient Clinics at Princess Raya hospital were responsible for 45 percent (JD 79,519) of all drug costs incurred by the hospital. The average drug costs amounted to 588 fils per ER visit, and 867 fils per outpatient visit. Under existing MOH cost-sharing rules, the outpatient co-payment for prescription drugs at all MOH hospitals, is 250 fils per prescription. Given that the hospital lacks information on the average number of prescriptions per patient, it is impossible to draw any substantive policy implications from the data presented in Table 28. However, anecdotal evidence suggests that the cost-sharing rules are slightly lower than hospital's the average drug cost, warranting a more detailed study of drug consumption.

Table 28: Distribution of Drug Costs by Emergency Room and Outpatient Clinic Visit

Cost Center	Total Drug Costs	Number of Visits	Drug Costs per Visit
Daily Hospital Services			
Emergency Room	JD 26,983	45,887	588 fils
Outpatient Clinics	JD 52,536	60,618	867 fils
Total	JD 79,519	106,505	747 fils

4. Accounting for Fixed Input Costs

This chapter reports on the costs of fixed inputs at Princess Raya hospital. As discussed in Chapter 2, fixed inputs are those factors of production whose quantity does not vary according to the volume of output. At Princess Raya, those inputs are hospital structure, vehicles, equipment, and furniture. The chapter first determines the costs of the fixed inputs, then discusses their distribution among hospital cost centers. It closes with discussion of unit costs of fixed inputs.

4.1 Estimating Costs of Fixed Inputs

The structure components of Princess Raya hospital are the hospital building, electrical structures, the plumbing and sewage system, and the kidney dialysis unit. The replacement costs of the structural components were estimated based on the original 1995 purchase prices, obtained from the Ministry of Finance (MOF),¹¹ which then were inflated over the 1995 to 1999 period. The costs of other fixed factors, such as vehicles, equipment, and furniture were based upon their replacement costs in 1999 Jordanian dinars.

The replacement cost of each fixed input then was annualized based on its useful working life. To do this, a definition of working life of each input, along with its depreciation factor was obtained from the MOF, according to ministry rules for estimating the useful working life of public sector capital inputs. The annualized economic costs of all fixed factors were estimated as follows: an annualization factor was estimated according to Equation (1), using a real interest rate of 3 percent, and the relevant depreciation factor.¹² The replacement cost of the fixed factor was then divided by the annualization factor.¹³ This yields the base year capital costs of employing the fixed factor (i.e., its 1999 economic costs).

$$A_f = 1/(r+d) \cdot [1-1/(1+r+d)^T] \quad (1)$$

where,

A_f = annualization factor

r = average real interest rate

d = depreciation factor

T = total working life-years of fixed factor

The annualized economic costs of the hospital's structural components are shown in Table 29. Assuming a total working life of 40 years, an average real interest rate of 3 percent, and a depreciation factor of 2.5 percent, the table lists the annualized economic costs that must be imputed onto the base year. The annualization factor calculated under this set of assumptions equaled 16.05.

¹¹ As is traditional, this study excludes land value from estimates about structural components, because land values typically exhibit significant geographic variation and overstate the capital costs of operating a facility.

¹² Real interest rates were obtained from the Export and Finance Bank, Research and Studies Investment Banking Unit.

¹³ This procedure yields the discounted present value of the fixed factor during the base year.

Table 29: Annualized Economic Costs of Fixed Hospital Structures

Fixed Factor	Replacement Costs (1999 JD)	Annualized Capital Costs 1999
Hospital Building	JD 2,149,463	JD 133,923
Electrical Structures	474,141	29,541
Sewage & Plumbing	636,521	39,659
Kidney Dialysis Unit	38,147	2,377
Total	JD 3,298,272	JD 205,500

Table 30 presents the annualized economic costs of each hospital vehicle. Replacement costs are based upon the 1999 insurance value of each vehicle model. Employing Equation (1), and assuming the MOF working life of seven years for each vehicle and a depreciation factor of 14.28 percent, the estimated annualization factor was 3.89.

Table 30: Annualized Economic Costs of Hospital Vehicles

Vehicle Number	Model	Replacement Costs	Annualized Capital Costs
12373	Tanker/Nissan	JD 14,000	JD 3,599
17386	Asia Bus	12,000	3,085
17532	Isuzu Salon	9,000	2,314
18705	Ambulance/Chevy	30,000	7,712
19561	Isuzu Pickup	13,000	3,342
21039	Ambulance/Dodge	45,000	11,568
26333	Mitsubishi Bus	11,300	2,905
Total		JD 134,300	JD 34,525

Table 31 presents the estimated annualized economic costs of the hospital's medical equipment and furniture inputs. (Annex A contains a complete list of the hospital's equipment and furniture inputs.) Replacement cost was obtained from the MOH Directorate of Procurement and Supplies. The MOF working life of both equipment and furniture is 10 years, and each has a depreciation factor of 10 percent. Based upon this set of assumptions the annualization factor estimated equaled 5.43.

Table 31: Annualized Economic Costs of Equipment and Furniture

Fixed Input	Replacement Costs	Annualized Capital Costs
Medical Equipment	JD 631,636	JD 116,322
Furniture	88,020	16,209
Total	JD 719,656	JD 132,531

4.2 Distribution of Fixed Cost by Cost Center

Table 32 shows the distribution of fixed cost components by cost center. The distribution was determined according to the following allocation rules:

- ▲ The hospital's annualized structural costs were allocated to each cost center in proportion to the total number of square meters occupied by each center according to hospital blueprints obtained from the MOH Department of Buildings.
- ▲ The total annualized costs of the hospital's vehicles were apportioned as follows: Total ambulance costs were allocated to the Emergency Room. Costs of the tanker used for waste disposal were distributed across inpatient costs centers according to their proportion of total adjusted inpatient days. Costs of hospital buses, used primarily for transporting nursing personnel from their residences to Princess Raya hospital, were allocated based upon the proportion of nursing personnel employed within each center. Costs of the pickup vehicle utilized for transporting small equipment and supplies to various hospital cost centers were distributed based upon the proportion of personnel assigned to a particular center, and the same procedure was followed for the passenger vehicle that is utilized for transporting administrative documents and small supplies.
- ▲ Medical equipment and furniture costs were apportioned to costs centers after an inventory of all such items was conducted, and their 1999 replacement cost obtained from the MOH Directorate of Procurement and Supplies.

The rightmost column of Table 32 presents by cost center the total fixed costs of operating Princess Raya hospital: JD 372,556 (\$521,578). The Operating Room exhibits the highest fixed costs of any center directly involved in the delivery of daily hospital services, JD 59,798. This amount is more than 38 percent higher than that of the OB/GYN department, the second highest cost center in terms of fixed cost. Fifty-two percent of the OR fixed costs is due to its fixed structure; approximately 45 percent is due to the fixed costs that are associated with its medical equipment. With respect to ancillary and support services, the highest category of fixed costs is that associated with the allocation of financial/administrative services, JD 39,617 (\$55,464).

Table 32: Distribution of Fixed Costs (F_c), by Cost Center

Cost Center	Structure	Vehicles	Medical Equipment	Furniture	Total Fixed Cost
Daily Hospital Services					
Surgery	JD 20,118	JD 2,378	JD 7,287	JD 1,107	JD 30,890
OB/GYN	25,461	3,251	13,262	1,192	43,166
Internal Medicine ¹	4,233	1,231	1,861	1,023	8,348
Emergency Room	6,787	20,959	6,070	667	34,483
ICU/CCU ²	14,564	591	8,838	341	24,334
Operating Room	31,154	1,416	26,638	590	59,798
Pediatrics	17,159	1,432	7,921	1,449	27,961
Outpatient Clinics	19,564	921	2,096	1,282	23,863
Subtotal	JD 139,040	JD 32,179	JD 73,973	JD 7,651	JD 252,843
Ancillary & Support Services					
Admin/Finance	JD 32,879	JD 781	--	JD 5,957	JD 39,617
Rehabilitation	2,687	48	6,994	341	10,070
X-ray Services	8,807	242	19,941	276	29,266
Laboratory Services	5,762	983	15,414	1,602	23,761
Pharmacy Services	5,798	242	--	308	6,348
Food & Beverage	10,527	50	--	74	10,651
Subtotal	JD 66,460	JD 2,346	JD 42,349	JD 8,558	JD 119,713
Total	JD 205,500	JD 34,525	JD 116,322	JD 16,209	JD 372,556

4.3 Estimating Per Unit Fixed Cost

As discussed in the preceding chapter, hospital output is approximated through the employment of various flow variables. The variables that have been utilized throughout this study are those that are typically employed in hospital cost studies: patient days (adjusted and unadjusted), bed days, patients, admissions and visits. When total fixed costs are considered relative to a particular flow variable, the result is equivalent to estimating the average fixed costs (AFCs) in terms of that variable.

This section of the report distributes Princess Raya hospital's total fixed cost by cost center, patient days, and adjusted patient days. Where appropriate, that information is presented as the hospital's AFC of producing a particular service category.

Table 33 shows the distribution of total fixed costs of hospital departments that deliver daily hospital services, by cost center, patient day, and adjusted patient day. In terms of adjusted patient days, the AFC of a patient day in the ICU/CCU amounted to JD 39. This represents the highest AFC for the centers directly involved in the provision of daily hospital services. Other cost centers involved in the distribution of daily hospitals services show significantly lower AFCs: Surgery at JD 6, OB/GYN at JD 5, Internal Medicine at JD 8, and Pediatrics at JD 11.

Table 33: Distribution of Total Fixed Costs, by Cost Center, Patient Days, and Adjusted Patient Days

Cost Center	Patient Days	Adjusted Patient Days	Total Fixed Costs	Average Fixed Cost	Adjusted Average Fixed Costs
Daily Hospital Services					
Surgery	5,123	5,023	JD 30,890	JD 6	JD 6
OB/GYN	6,092	7,912	41,166	7	5
Internal Medicine	1,518	1,005	8,348	5	8
ICU/CCU	651	620	24,483	38	39
Pediatrics	3,564	2,458	27,961	8	11
Total	16,948	17,018	JD 132,848	JD 8	JD 8

Table 34 shows AFCs in terms of hospital admissions, both adjusted and unadjusted. Again, the highest AFC (JD 116) is found in the ICU/CCU department. As has been noted throughout this report, the OB/GYN department consistently exhibits the lowest per unit cost of all centers that are involved in the allocation of daily hospital services; its AFC is JD 12.

Table 34: Distribution of Total Fixed Costs, by Cost Center, Admissions, and Adjusted Admissions

Cost Center	Total Admissions	Adjusted Admissions	Total Fixed Costs	Fixed Costs Per Admission	Fixed Cost Per Adjusted Admission
Daily Hospital Services					
Surgery	1,761	1,726	JD 30,890	JD 18	JD 18
OB/GYN	2,688	3,491	41,166	15	12
Internal Medicine	371	246	8,348	22	34
ICU/CCU	222	211	24,483	110	116
Pediatrics	897	619	27,961	31	45
Total	5,939	6,293	JD 132,848	JD 22	JD 21

Table 35 provides information on AFC in terms of variables that are associated with the distribution of outpatient services. As illustrated, the AFC (in terms of visits) is more than 90 percent higher for Emergency Room visits than for Outpatient Clinic visits.

Table 35: Distribution of Total Fixed Costs, by Outpatient and Emergency Room Visits

Cost Center	Total Visits	Total Fixed Costs	Fixed Cost Per Visit
Daily Hospital Services			
Emergency Room	45,887	JD 34,483	751 fils
Outpatient Clinics	60,618	23,863	394 fils
Total	106,505	JD 58,346	548 fils

5. Estimating Total Hospital Costs

This chapter estimates the total costs of providing services at Princess Raya hospital. As was illustrated in Chapter 2, total economic cost (TC) is the sum of the total variable costs (TVC) and total fixed costs of operating an institution. Chapter 3 provided a detailed estimation of Princess Raya hospital's total variable costs, based on the hospital's labor and nonlabor variable inputs. Chapter 4 estimated the hospital's total fixed costs by considering the costs of its fixed structure, vehicle, furniture and equipment inputs.

5.1 Distribution of Total Costs by Cost Center

Table 36 summarizes the total variable costs, total fixed costs, and total operating costs of Princess Raya hospital in 1999, by cost center. Table 37 shows the percent distribution of those same costs.

Table 36: Distribution of Total Costs, by Cost Center

Cost Center	Total Variable Costs	Total Fixed Cost	Total Cost
Daily Hospital Services			
Surgery	JD 167,786	JD 30,890	JD 198,676
OB/GYN	138,826	43,166	181,992
Internal Medicine ¹	62,726	8,348	71,074
Emergency Room	99,496	34,483	133,979
ICU/CCU ²	47,849	24,334	72,183
Operating Room	163,609	59,798	223,407
Pediatrics	105,908	27,961	133,869
Outpatient Clinics	172,974	23,863	196,837
Subtotal	JD 959,174	JD 252,843	JD 1,212,017
Ancillary & Support Services			
Admin/Finance	JD 214,116	JD 39,617	JD 253,733
Rehabilitation	11,631	10,070	21,701
X-ray Services	63,754	29,266	93,020
Laboratory Services	54,485	23,761	78,246
Pharmacy Services	120,149	6,348	126,497
Food & Beverage	96,374	10,651	107,025
Subtotal	560,509	119,713	680,222
Total	JD 1,519,683	JD 372,556	JD 1,892,239

Table 37: Percent Distribution of Total Costs, by Cost Center

Cost Center	Total Variable Costs	Total Fixed Cost	Total Cost
Daily Hospital Services			
Surgery	11.0%	8.3%	10.5%
OB/GYN	9.1	11.6	9.6
Internal Medicine ¹	4.1	2.2	3.8
Emergency Room	6.5	9.2	7.1
ICU/CCU ²	3.1	6.5	3.8
Operating Room	10.8	16.1	11.8
Pediatrics	7.0	7.5	7.1
Outpatient Clinics	11.4	6.4	10.4
Subtotal	63.1%	67.9%	64.1%
Ancillary & Support Services			
Admin/Finance	14.1%	10.6%	13.4
Rehabilitation	.77	2.7	1.1
X-ray Services	4.2	7.8	4.9
Laboratory Services	3.6	6.4	4.1
Pharmacy Services	7.9	1.7	6.7
Food & Beverage	6.3	2.8	5.6
Subtotal	36.9%	32.1%	35.9%
Total	100%	100%	100%

As the tables show, nearly two-thirds of the hospitals' operating costs – whether variable, fixed or total – is consumed by centers directly engaged in the delivery of daily hospital services. This finding is not surprising. Also unsurprising is that the highest percent of variable and fixed costs are those allocated to the distribution of administrative/financial and operating room services, respectively.

What is startling, however, is that the highest percentage (13.4 percent, or, in nominal terms, JD 253,733/\$355,226) of total costs is allocated towards the distribution of administrative/financial services.¹⁴ In fact, this represents a lower-bound estimate, given that this analysis excludes the proportion of administrative/financial services that are conducted by the central ministry on behalf of Princess Raya hospital. For example, the central ministry conducts all procurement (e.g., drugs, devices, and equipment) and most administrative functions that are associated with personnel issues. Under optimal circumstances, such costs would be included in the analysis. However, the lack of an effective budget tracking system within the MOH precluded obtaining robust estimates of such central ministry expenditures.

¹⁴This amount is significantly lower than the national average for U.S. hospitals, 25 percent.

5.2 Total Costs Per Unit of Output

This section discusses Princess Raya's operating costs per unit of output, using the flow variables that have been employed throughout this study: patient days (adjusted and unadjusted), bed days, patients, admissions, and visits. The result is equivalent to estimating the average total costs (ATC) in terms of that variable. This section also considers various ATC estimates of operating Princess Raya hospitals, in terms of the aforementioned flow variables.

As Table 38 shows, the costs of ICU/CCU services is the highest among all categories of daily hospital services in terms of both unadjusted and adjusted patient days, JD 111 and JD 116, respectively. This is expected given the significant amounts of variable and fixed factors that are used in the treatment of ICU/CCU patients. Treatment of OB/GYN patients has the lowest ATCs, JD 30 for unadjusted patient days and JD 23 for adjusted patient days. Additional information concerning the hospital's total costs may be extrapolated from the data. For example, as was discussed in Section 3.5, Princess Raya hospital delivered 2,202 newborns in its OB/GYN department. Given total OB/GYN operating costs of JD181,992, the ATC is roughly JD83 (\$116) per delivery.¹⁵

Table 38: Distribution of Total Costs, by Cost Center, Patient Days, and Adjusted Patient Days

Cost Center	Patient Days	Adjusted Patient Days	Total Costs	Average Total Costs	Adjusted Average Total Costs
Daily Hospital Services					
Surgery	5,123	5,023	JD 198,676	JD 39	JD 39
OB/GYN	6,092	7,912	181,992	30	23
Internal Medicine	1,518	1,005	71,074	47	71
ICU/CCU	651	620	72,183	111	116
Pediatrics	3,564	2,458	133,869	38	54
Total	16,948	17,018	JD 657,794	JD 39	JD 39

Table 39 shows estimates of ATCs in terms of hospital admissions, both adjusted and unadjusted. The highest ATC occurs in the production of ICU/CCU services. The lowest ATC occurs during the production of OB/GYN services. In fact, with an adjusted ATC of roughly JD 52 (\$73) OB/GYN service production is 120 percent lower than that of surgical service production, and 315 percent lower than that of pediatric service production.

¹⁵ Utilizing the data obtained in this document, the PHR*plus* Health Insurance Pilot project has estimated the total costs per maternity case, including outpatient and inpatient treatment, as well as making adjustments for vaginal and Caesarian cases, to be JD158 per case at Princess Raya hospital. See Duffy, 2002.

Table 39: Distribution of Total Costs, by Cost Center, Admissions and Adjusted Admissions

Cost Center	Total Admissions	Adjusted Admissions	Total Costs	Total Costs Per Admission	Total Costs Per Adjusted Admission
Daily Hospital Services					
Surgery	1,761	1,726	JD 198,676	JD 113	JD 115
OB/GYN	2,688	3,491	181,992	68	52
Internal Medicine	371	246	71,074	192	289
ICU/CCU	222	211	72,183	325	342
Pediatrics	897	619	133,869	149	216
Total	5,939	6,293	JD 657,794	JD 111	JD 104

Table 40 presents total cost and total cost per visit of Emergency Room and Outpatient Clinic visits to Princess Raya hospital during the period of this study. As defined in Section 3.5, a visit is the appearance of a patient in the hospital for ambulatory and/or ancillary services, and, as shown in Table 26, the AVC of an ER or clinic visit is JD 2.17 and JD 2.85, respectively. As shown in Table 40, the ATC of these services is JD 2.92 and JD 3.25, respectively. This implies that 75 percent of the average costs associated with the production of Emergency Room services, and 88 percent of the average costs associated with the production of clinic services, is consumed by variable inputs.

Table 40: Distribution of Total Costs, by Emergency Room and Outpatient Visits

Cost Center	Total Visits	Total Costs	Total Cost Per Visit
Daily Hospital Services			
Emergency Room	45,887	JD 133,979	JD 2.92
Outpatient Clinics	60,618	196,837	3.25
Total	106,505	JD 330,816	JD 3.11

Table 41 contains the unit costs of hospital services, loaded with administrative/financial costs. These administrative/financial costs represent an average of 38.5 percent of total costs of daily hospital services.

Table 41: Per Unit Daily Hospital Services Loaded With Admin/Finance Costs

Cost Center	Total Costs	Admin/Finance (Loaded) Costs	Total Costs (TC) + (Loaded)	Loaded TC per Adjusted Patient Day
Daily Hospital Services				
Surgery	JD 198,676	JD 74,934	JD 273,610	JD 54
OB/GYN	181,992	117,735	299,272	38
Internal Medicine	71,074	15,014	86,088	85
ICU/CCU	72,183	9,247	81,430	131
Pediatrics	133,869	36,803	170,672	69
Total	JD 657,794	JD 253,733	JD 911,072	JD 54

6. Policy Implications and Conclusion

This detailed economic analysis of the cost of producing hospital services at Princess Raya hospital marks completion of an additional step in the Ministry of Health's decentralization of its 23 publicly owned and operated hospitals. The first phase of this process began nearly four years ago when the MOH, with the technical assistance of the Hospital Decentralization Implementation Team, selected Princess Raya and Al Karak hospitals as its two pilot institutions from which this process would begin. Since then, under phase two, the MOH has made significant strides in this effort. In addition to implementing several short-run changes in existing rules and regulations, the MOH has designed and approved of the establishment of hospital governing boards at each hospital, as well as supported the extensive training activities that both PHR and PHR*plus* have provided to hospital personnel. The information contained in this cost study will provide the MOH with needed information that will assist it in its future design of an appropriate operating budget for each hospital. However, prior to implementing such a budget, several key issues must be addressed.

Firstly, an appropriate managerial cost accounting system does not exist at either hospital. Having such a system in place is a necessary condition for keeping track of monetary flows throughout the system, and it is an essential tool for assisting department managers, i.e., cost center managers, to manage their resources efficiently. For example, currently the hospitals do not effectively track the costs and amounts of drugs consumed by each department. As a result, in order to estimate drug expenditures by costs center (department), the Implementation Team had to design a survey instrument to track drug consumption. In tracking consumption, the survey found that each hospital has excess inventory of certain drug categories and a shortage of others, which it attributes to the highly centralized MOH procurement and supply process. An effective managerial cost accounting system and better coordination between the hospital and the MOH Procurement and Supplies division should allow for more efficiency in hospital drug inventories. PHR*plus* will assist Princess Raya and Al Karak hospitals in the development of a managerial cost accounting system.

Secondly, because labor costs represent 40 percent of Princess Raya hospital's total operating costs, the employment and distribution of labor throughout the hospital has significant overall cost implications. As this study shows, the Internal Medicine department of the hospital appears to be overstaffed. While this finding cannot be substantiated without further studies on the relative productivity of employees within each department, it implies that the MOH should make a greater effort in tracking the total number of work hours, both productive and nonproductive, for all hospital employees and develop a system to accurately estimate the number of full-time equivalent hours that are worked by hospital employees, not only at Princess Raya, but at other MOH hospitals as well. In looking at labor costs the study also revealed that, due to existing MOH and Civil Service rules, personnel records at the central ministry are not updated and matched against the hospital's personnel records on a regular basis. For example, the study found that personnel reassigned from Princess Raya hospital to other MOH facilities often are still listed as Princess Raya employees in central ministry records. This problem can be eliminated thorough the development of a more effective system of communication and reporting between the MOH personnel division and the hospital. In this study labor costs were treated as a variable factor. The ability of a hospital manager to vary labor inputs is a matter of MOH policy. The implementation of a managerial cost accounting system will provide

MOH policymakers and hospital managers additional data to recommend hospital workforce policies that increase efficiency within each cost center.

Finally, it would be inappropriate to use this study to make any conclusion about cost-sharing. More analysis of the hospital's services production, and the economic and demographic profiles of its patients are needed prior to implementing changes in the existing policies. However, implementation of managerial cost accounting systems, based on the framework suggested by this study, is a logical next step that will add to the complete understanding of hospital costs. This understanding is essential before accurate cost-sharing systems can be designed and implemented.

Annex A: Summary Tables of Allocation Rules

Table A1: Allocation Rules for Utility Cost Estimates, and Variable Structure and Equipment Estimates (See Tables 15 and 16)

Input Category	Allocation Rule	Note
Labor Cost	Distributed according to percent time assigned to relevant cost center	Example, 20% of time implied 20% of labor remuneration to the particular cost center
Fuel, Butane Gas, Electricity, and Water	Distributed according to the percent of square meters of physical space occupied by a respective cost center ¹	Example, 10% of occupied physical space implied 10% allocation of total costs
Telephone Services	Distributed according to the percent of telephone lines that are distributed to the relevant cost center	Example, 5% of hospital telephone lines, entailed 5% distribution of total costs to relevant center
Building Renovations, Maintenance	Distributed according to the percent of square meters of physical space occupied by a respective cost center ¹	Example, 10% of occupied physical space implied 10% allocation of total renovation costs
Rental Quarters for Nurses	Distributed according to the percent of nursing staff employed in a particular cost center	Quarters rentals are overnight facilities for nursing staff
Building and Equipment Maintenance, Renewal and Supplies	Distributed based upon the current costs of maintenance and renewal for a particular cost center	

¹Based upon blueprint estimates that were obtained from the MOH Department of Buildings

Table A2: Allocation Rules Variable Hospital Consumables, Contracted Services, and Nonclinical Supplies (See Tables 17 thru 19)

Input Category	Allocation Rule	Note
Drugs and Medications	Distributed based upon the percent of medications allocated to a particular cost center	Based upon a survey of drug consumption, by cost center, that was conducted over a two-month period
Gases	Distributed based upon the percent of gas valve connections that were available in a particular cost center	Example, 10% of gas valve connectors implied 10% of total cost to be distributed to the relevant cost center
Medical Consumables	Distributed based upon the percent of patient days	Example, cost center that represented 5% of patient days received 5% of total costs
Laboratory and Radiological Consumables	Distributed based upon the percent of patient days	
Contracted Services	Distributed based upon the percent of patient days	
Nonclinical Supplies	Distributed based upon the percent of patient days	

Table A3: Allocation Rules for Fixed Hospital Structure, Vehicles, Equipment and Furniture (see Tables 28 thru 30)

Input Category	Allocation Rule	Note
Hospital Building, Electrical Structures, Sewage and Plumbing	Costs distributed based upon the proportion of square meters	Blueprints obtained from the MOH Department of Buildings
Kidney Dialysis Unit	Costs allocated to the Internal Medicine cost center	Kidney dialysis unit is located within the internal medicine department
Ambulances	Costs allocated to Emergency Room cost center	Emergency transport vehicle
Tanker	Costs allocated based upon inpatient days	Vehicle used for waste disposal
Buses	Costs allocated according to percent of nursing personnel assigned to a particular costs center	Buses are used for transporting nursing personnel from residences to hospital
Pickup and Isuzu Salon	Costs allocated according to the percent of total personnel assigned to a given cost center	Vehicles are utilized for transporting documents and other small material from the central ministry to the hospital, or within the governorate

Annex B: Service Inventory of Princess Raya Hospital

REPORTING REQUIREMENT SERVICES INVENTORY (“X” indicates that service is offered)

	Offer		Offer		Offer
DAILY HOSPITAL SERVICE		LABORATORY SERVICES		CLINIC SERVICES	
INTENSIVE CARE SERVICES		Microbiology		Dental	
Burn	X	Necropsy		Dermatology	X
Coronary	X	Serology	X	Diabetes	X
Medical	X	Surgical Pathology		Drug Abuse	
Neonatal	X	DIAGNOSTIC IMAGING SERVICES		Family Therapy	
Neurosurgical		Computed Tomography		Group Therapy	
Pediatrics	X	Cystoscopy	X	Hypertension	X
Pulmonary	X	Magnetic Resonance Imaging		Metabolic	
Surgical	X	Position Emission Tomography		Neurology	
Definitive Observation Care	X	Ultrasonography	X	Neonatal	
ACUTE CARE SERVICES		X-Ray Radiology	X	Obesity	
Alternate Birthing Center (licensed beds)		DIAGNOSTIC THERAPEUTIC SERVICES		Obstetrics	X
Geriatric		Audiology		Ophthalmology	X
Medical	X	Biofeedback Therapy		Orthopedic	X
Neonatal	X	Cardiac Catheterization		Otolaryngology	X
Oncology	X	Cohart Therapy		Pediatrics	X
Orthopedic	X	Diagnostic Radioisotope		Pediatrics Surgery	X
Pediatric	X	Echocardiology		Podiatry	
Physical Rehabilitation	X	Electrocardiology	X	Psychiatric	
Post Partum	X	Electroencephalography		Renal	
Surgical	X	Electromyography		Rheumatic	
Transitional Inpatient Care (Acute beds)	X				
NEWBORN CARE SERVICES		Endoscopy		Rural Health	
Developmentally Disabled Nursery		Gastro-Intestinal Laboratory		Surgery	X

Newborn Nursery Care	X	Hyperbaric Chamber Services			
Premature Nursery Care	X	Lithotripsy		HOME CARE SERVICES	
Hospice care	X	Nuclear Medicine		Home Health Aids Services	
Inpatient Care under Custody (Jail)	X	Occupational Therapy		Home Nursing Care (Visiting Nurse)	
LONG-TERM CARE		Physical Therapy	X	Home Physical Medicine Care	
Behavioral Disorder Care		Peripheral Vascular Laboratory		Home Social Service care	
Developmentally Disabled Care		Pulmonary Function Services		Home dialysis Training	
Intermediate Care		Radiation Therapy		Home Hospice Care	
Residential / Custodial Care		Radium Therapy		Home IV Therapy Services	
Self Care		Radioactive Implants		Jail Care	
Skilled Nursing Care	X	Recreational Therapy		Psychiatric Foster Home Care	
Sub-acute Care	X	Respiratory Therapy Services			
Sub-acute Care Pediatric	X				
Transitional Inpatient Care (SNF Beds)	X				
CHEMICAL DEPENDENCY-DETOX		Speech-Language Pathology		AMBULATORY SERVICES	
Alcohol		Sports Care Medicine		Adult Day Health Care Center	
Drug		Stress Testing		Ambulatory Surgery Services	X
CHEMICAL DEPENDENCY-Rehabilitation		Therapeutic Radioisotope		Comprehensive Outpatient Rehab. Facility	
Alcohol		X-ray Radiology Therapy		Observation (short stay) Care	
Drug		PSYCHIATRIC SERVICES		Satellite Ambulatory Surgery Services	
PSYCHIATRIC SERVICES		Clinic Psychologist Services		Satellite Clinic Services	
Psychiatric Acute – Adult		Child Care Services	X		
Psychiatric – Adolescent and child		Electroconvulsive Therapy (shock)		OTHER SERVICES	
Psychiatric Intensive (Isolation) Care		Milieu Therapy		Diabetic Training Class	
Psychiatric Long-term Care		Night Care		Diabetic Counseling	X
		Psychiatric Therapy		Drug Reaction Information	

OBSTETRIC SERVICES		Psychopharmacological Therapy		Family Planning	X
Abortion Services		Sheltered Workshop		Genetic Counseling	
Combined Labor / Delivery Birthing Room	X	RENAL DIALYSIS		Medical Research	
Delivery Room Service		Hemodialysis	X	Parent training Class	
Infertility Services	X	Home dialysis support services		Patient Representative	
Labor Room Service	X	Peritoneal		Public Health Class	
SURGERY SERVICES		Self-dialysis Training		Social Work Service	
Dental	X	Organ Acquisition		Toxicology / Antidote Information	
General	X	Blood bank	X	Vocational Services	
Gynecologic	X	Extracorporeal Membrane Oxygenation			
Heart	X	Pharmacy	X	MEDICAL EDUCATIONAL PROGRAMS	
Kidney	X			Approved Residency	
Neurosurgical		EMERGENCY SERVICES		Approved Fellowship	
Open-heart		Emergency Communication System	X	Non-approved Residency	
Ophthalmologic	X	Emergency Helicopter Service	X	Associate Records Technician	
Organ transplant	X	Emergency Observation Service	X	Diagnostic Radiologist Technologist	
Orthopedic	X	Emergency Room Service	X	Dietetic Intern Program	
Otolaryngologic	X	Heliport (landing facility only)	X	Emergency Medical Technician	
Pediatric	X	Medical Transportation	X	Hospital Administration Program	
Plastic		Mobile Cardiac Care Service		Licensed Vocational Nurse (Assistant Nurse)	
Podiatry		Orthopedic Emergency Services	X	Medical Technologist Program	
Thoracic		Psychiatric Emergency Services		Medical Records Administrator	
Urologic	X	Radioisotope Decontamination Room		Nurse Anesthetist	
Anesthesia Services	X	Trauma Treatment ER	X	Nurse Practitioner	

				Nurse/Midwife	
LABORATORY SERVICES		CLINIC SERVICES		Occupational Therapist	
Anatomical Pathology		AIDS		Pharmacy Intern	
Chemistry	X	Alcoholism		Physician`s Assistant	
Clinical Pathology		Allergy		Physical Therapist	
Cytogenetics		Cardiology		Registered Nurse	
Cytology	X	Chest Medical	X	Respiratory Therapist	
Hematology		Child Diagnosis		Social Worker Program	
Histocompatibility		Child Treatment			
Immunology		Communicable Disease			

Annex C: Fixed Assets (Equipment and Furniture Inventory) of Princess Raya Hospital

Medical Equipment or Devices/Emergency Department Items with replacement of JD 100(\$140) or more

Item No.	Name of the Medical Equipment/ Device	Number	Cost per Item		Total Cost
			Dinars	Fils	
1	Portable side lamp	1	118		118
2	Laryngoscopes	9	200		1800
3	Dressing set	2	400		800
4	Ambu bags (for ventilation purposes)	2	100		200
5	Otoscope standard	1	200		200
6	Suction machine	1	1000		1000
7	Sphygmomanometers	8	100		800
8	Diagnostic set	5	100		500
9	DC shock with ECG (Electrocardiograph) monitor	2	5000		10,000
10	Pulse oximeter	1	2000		2000
11	Emergency trolley	1	3000		3000
12	Wheelchair	2	150		300

Medical Equipment or Devices/ Clinics Department
Items with replacement of JD 100 (\$140) or more

Item No.	Name of the Medical Equipment/Device	Number	Item Cost		Total Cost
			Dinars	Fils	
1	Resuscitation	1	4000		4000
2	Suction machine	1	1000		1000
3	Sonicaid	3	100		300
4	Baby scale	2	100		200
5	Suction curettage unit	3	500		1500
6	Doplar sonicaid	2	500		1000
7	Laryngoscope	3	200		600
8	Hot air oven	1	400		400
9	DC shock with ECG Monitor (Electro cardiograph)	1	5000		5000
10	Retinoscope	1	200		200
11	Ophthalmoscope	1	150		150
12	Recto-sigmoid scope	1	214		214
13	Wall lamp	2	100		200
14	Osculating cutter	1	400		400

Medical Equipment or Devices/Gynecology and Obstetrics Department
Items with replacement of JD 100(\$140) or more

Item No.	Name of the Medical Equipment/ Device	Number	Item Cost		Total Cost
			Dinars	Fils	
1	Resuscitation	1	4000		4000
2	Suction machine	1	1000		1000
3	Fetal neo-natal care	2	300		600
4	Sonicaid	3	150		450
5	Baby scale	2	150		300
6	Suction curettage unit	3	1000		3000
7	Doplar sonicaid	2	500		1000
8	Laryngoscopes	3	200		600
9	Hot air oven	1	700		700
10	ECG machine	1	1000		1000
11	X-ray viewer	1	100		100

Medical Equipment or Devices /X-ray Department
Items with replacement of JD 100 (\$140) or more

Item No.	Name of the Medical Equipment/Device	Number	Item Cost		Total Cost
			Dinars	Fils	
1	Portable X-ray	1	8000		8000
2	Ultrasound	2	15000		30,000
3	Camera for U/S	2	2000		4000
4	Shimadzne X-ray (type of colored X-ray)	1	25,000		25,000
5	Shimadzne X-ray (non-colored X-ray)	1	20,000		20,000
6	X-ray automatic	1	7000		7000
7	Manual processor	1	4,500		4,500
8	Optimax automatic	1	6000		6000
9	Protective set	5	300		6000
10	Aprons lead	4	125		500

Medical Equipment or Devices /Laboratory Department
Items with replacement of JD 100(\$140) or more

Item No.	Name of the Medical Equipment/Device	Number	Item Cost		Total Cost
			Dinars	Fils	
1	Flame photometer	2	2500		5000
2	Microscope	4	500		2000
3	Shaker	2	400		800
4	Hematocrit reader	2	400		800
5	Centrifuge tube	3	600		1800
6	Autoclave	1	600		600
7	Distiller	2	2000		4000
8	Water bath	2	500		1000
9	Michrohmatocrit centrifuge	3	600		1800
10	Incubator	2	500		1000
11	Spectrophotometer	1	4000		4000
12	BTR Bio-photometer	1	3000		3000
13	Blood gas machine	1	24,500		24,500
14	Chemistry analyzer	1	24,399		24,399
15	Electrolyte analyzer	1	3000		3000
16	Digital Ph meter	1	3000		3000
17	Hematology analyzer	1	30,000		30,000

Medical Equipment or Devices/Physical Therapy Department
Items with replacement of JD 100(\$140) or more

Item No.	Name of the Medical Equipment/ Device	Number	Item Cost		Total Cost
			Dinars	Fils	
1	Paraffin bath (large)	3	500		1500
2	Trolley for machine	1	100		100
3	Endovac model	1	2000		2000
4	Interferential machine	2	4500		9000
5	Dynatron 438 (machine for toning muscles)	1	4000		4000
6	Sonopulse 434	1	3300		3300
7	Wall bar	1	100		100
8	Parallel bar	1	100		100
9	Curopulse 403		4000		4000
10	Ergrometer 990(fixed bicycle)	1	200		200
11	Tilt table mobile	1	200		200
12	Quadriceps bench	1	400		400
13	Polly system wall	1	150		150
14	Electreck 471 mobile	1	3000		3000
15	Hydrotherapy unit mobile	1	300		300
16	Hydro collator	1	700		700
17	Traction unit	1	2000		2000

Medical Equipment or Devices /Internal Medicine Department
Items with replacement of JD 100(140 \$) or more

Item No.	Name of the Medical Equipment/Device	Number	Item Cost		Total Cost
			Dinars	Fils	
1	Ophthalmoscope	1	200		200
2	Diagnostic set	1	100		100
3	X-ray viewer	1	100		100
4	Sphygmomanometer monitor	1	1000		1000
5	Laryngoscope	1	200		200
6	DC shock with ECG (electrocardiograph) monitor	1	5000		5000

**Medical Equipment or devices /Operating Room
Items with replacement of JD 100(140 \$) or more**

Item No.	Name of the Medical Equipment/Device	Number	Item Cost		Total Cost
			Dinars	Fils	
1	Infant resuscitation	1	4000		4000
2	Air compressor	1	1000		1000
3	Electric sterilizer	1	250		250
4	Laparoscopes	2	10,000		20,000
5	Electrical suctions	2	800		1600
6	Hot air oven	1	600		600
7	Power drill	1	6250		6250
8	Bedpan washer	1	2000		2000
9	Ophthalmic microscope	1	10,000		10,000
10	Recto–sigmoid	2	300		600
11	Light source	1	300		300
12	Fogmaster	1	200		200
13	Wallach freezer	1	1000		1000
14	Capnometer	1	1500		1500
15	Sphygmomanometer with monitor	1	1000		1000
16	Otoscope	1	150		150
17	Respiration monitor	1	4000		4000
18	Fastric monitor	1	1250		1250
19	Washer disinfection	1	2000		2000
20	Ultraviolet	1	400		400
21	Capnocheck pulse	2	1500		3000
22	Defigard/DC	1	3000		3000
23	Operating room light	3	9703		29,109
24	Anesthesia machine	2	10,000		20,000
25	Laryngeal masks	1	150		150
26	Laryngoscopes	3	200		600
27	Pain circuit	1	100		100
28	Magill circuit	1	100		100

Medical Equipment or Devices /Intensive Care Unit (ICU)
Items with replacement of JD 100(\$140) or more

Item No.	Name of the Medical Equipment/Device	Number	Item Cost		Total Cost
			Dinars	Fils	
1	Diagnostic Set	1	100		100
2	Laryngoscope	1	200		200
3	Tongue plate set	1	461		461
4	Infusion pump	2	250		250
5	Anesthesia trolley	1	200		200
6	Solid dressing trolley	1	100		100
7	DC Shock with ECG Monitor	1	5000		5000
8	Circulate air cushion	3	300		900
9	Sigmoid scope	1	500		500
10	Cardioscope monitor	1	5220		5220
11	Central station monitor	1	7000		7000
12	Beside monitor	3	4000		12,000
13	Portable ventilator	2	4500		9000
14	Infusion pump	1	250		250
15	Spirometer portable	1	200		200

Medical Equipment or Devices/Surgery Department
Items with replacement of JD 100(\$140) or more

Item No.	Name of the Medical Equipment/Device	Number	Item Cost		Total Cost
			Dinars	Fils	
1	Laryngoscope	2	200		400
2	Ophthalmoscope	1	200		200
3	Diagnostic set	1	100		100

Medical Equipment or Devices/Pediatrics Department
Items with replacement of JD 100(\$140) or more

Item No.	Name of the Medical Equipment/ device	Number	Item Cost		Total Cost
			Dinars	Fils	
1	Respiration monitor	1	4000		4000
2	Laryngoscope	2	200		400
3	Baby scale	4	100		400
4	Electric sterilizer	3	250		750
5	Table for metal neonatal care	1	200		200
6	Infusion pump	1	250		250
7	Resuscitation	1	4000		4000
8	Photo therapy unit	2	1500		3000
9	Transport incubator	3	3933		11800
10	Infant incubator	1	600		600
11	Suction machine	1	1000		1000
12	Respirator humid fire	1	1000		1000
13	Gluko-meter pack	1	100		100
14	Otoscope standard	1	200		200
15	Diagnostic set	1	100		100

Furniture/Emergency Department
Items with replacement of JD 100 (\$140) or more

Item No.	Item Name/Description	Number	Item Cost		Total Cost	
					Dinars	Fils
1	Suspension file cabinet with drawers	1	180		180	
2	Iron wardrobe with one door	2	180		360	
3	Wooden closet 87x 49x5	1	180		180	
4	Wooden counter	1	330		330	
5	Treatment wooden table	1	190		190	

Furniture/Clinics Department
Items with replacement of JD 100 (\$140) or more

Item No.	Item Name/Description	Number	Item Cost		Total Cost	
					Dinars	Fils
1	Suspension file cabinet with drawers	7	180		1260	
2	Wooden cabinet with two doors	2	180		360	

Furniture/Obstetrics and Gynecology Department
Items with replacement of JD 100 (\$140) or more

Item No.	Item Name / Description	Number	Item Cost		Total Cost	
					Dinars	Fils
1	Refrigerator "Golden" 8 feet	1	220		220	
2	Fully equipped patient bed with food tray	12	340		4080	
3	Study or office desk	1	180		180	

Furniture/X-Ray Department
Items with replacement of JD 100 (\$140) or more

Item No.	Item Name/Description	Number	Item Cost		Total Cost	
					Dinars	Fils
1	Doctor's office desk	1	180		180	
2	Wooden shelf	1	108		108	

Furniture/Laboratory Department
Items with Replacement of JD 100 (\$140) or more

Item No.	Item Name/Description	Number	Item Cost		Total Cost	
					Dinars	Fils
1	Office table	1	180		180	
2	Blood bank refrigerator	2	1500		3000	
3	Lab refrigerator	3	680		2040	
4	Blood donation bed	2	422		844	
5	Airconditioner	1	1050		1050	

Furniture/Nutrition
Items with replacement of JD 100 (\$140) or more

Item No.	Item Name/Description	Number	Item Cost		Total Cost	
					Dinars	Fils
1	Office table with three drawers	1	180		180	

Furniture/Physical Therapy
Items with replacement of JD 100 (\$140) or more

Item No.	Item Name/Description	Number	Item Cost		Total Cost	
					Dinars	Fils
1	Office table with drawers	1	180		180	
2	Wooden couch or sofa	1	120		120	

Furniture/Pharmacy
Items with Replacement of JD 100 (\$140) or more

Item No.	Item Name / Description	Number	Item Cost		Total Cost	
					Dinars	Fils
1	Office table with drawers	3	180		540	
2	Refrigerator "16 feet"	1	470		470	

Furniture/Internal Medicine
Items with replacement of JD 100 (\$140) or more

Item No.	Item Name/Description	Number	Item Cost		Total Cost	
			Dinars	Fils	Dinars	Fils
1	Bed equipped for children	1	150		150	
2	Wooden closet 190x45x90	1	180		180	
3	Patient bed equipped with food tray	11	340		3470	
4	Office desk with drawers	1	180		180	
5	Refrigerator "10 feet"	1	200		200	

Furniture/Surgery/Operating Room
Items with replacement of JD 100 (\$140) or more

Item No.	Item Name/Description	Number	Item Cost		Total Cost	
			Dinars	Fils	Dinars	Fils
1	Closet with two doors	2	180		360	
2	Office desk with drawers	2	180		360	
3	Patient bed	1	340		340	

Furniture/Intensive Care Unit
Items with replacement of JD 100 (\$140) or more

Item No.	Item Name/Description	Number	Item Cost		Total Cost	
			Dinars	Fils	Dinars	Fils
1	Office desk with drawers	1	180		180	
2	Wooden closet with dimensions 190x45x90	2	180		360	
3	Hydraulic bed	3	723		2169	
4	Sponge mattress divided into levels to relieve the patient (highly compacted to low compacted)	3	150		450	

Furniture/Surgery (Male department)
Items with Replacement of JD 100 (\$140) or more

Item No.	Item Name / Description	Number	Item Cost		Total Cost	
					Dinars	Fils
1	Patient bed equipped with food tray	12	340		4080	
2	Office desk with drawers	1	180		180	
3	Wooden closet with dimensions 190x 45x90	2	180		360	
4	Refrigerator "10 feet "	1	220		220	

Furniture/(Pediatrics department)
Items with replacement of JD 100 (\$140) or more

Item No.	Item Name/Description	Number	Item Cost		Total Cost	
					Dinars	Fils
1	Baby's bed (infant's bed)	9	140		1260	
2	Wooden closet 190x 45x 90 cm	1	180		180	
3	Patient bed equipped with food tray	4	340		1360	
4	Office desk with drawers	1	180		180	
5	Weight balance for (adults)	1	120		120	
6	Counter	1	1070		1070	
7	Refrigerator	1	220		220	

Furniture/Administration Department
Items with replacement of JD 100 (\$40) or more

Item No.	Item Name/Description	Number	Item cost		Total Cost	
					Dinars	Fils
1	Manager's office desk	2	250		500	
2	Office desk with drawers	21	180		3780	
3	Manager's office chair	2	120		240	
4	Closet for keeping medical records	32	137		4384	
5	Samsung television sets	2	320		640	
6	Closet with three doors	4	250		1000	
7	Photocopy machine	1	980		980	
8	Printer	3	450		1350	
9	Water cooler	3	250		750	
10	Wooden wardrobe with two doors	11	180		1980	
11	Refrigerator	3	220		660	
12	Counter for the medical records	1	1200		1200	
13	Large panel meeting room table for the developing unit	1	420		420	
14	Dixon shelves wooden cover (divided into partitions)	1	2200		2200	

Annex D: Bibliography

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